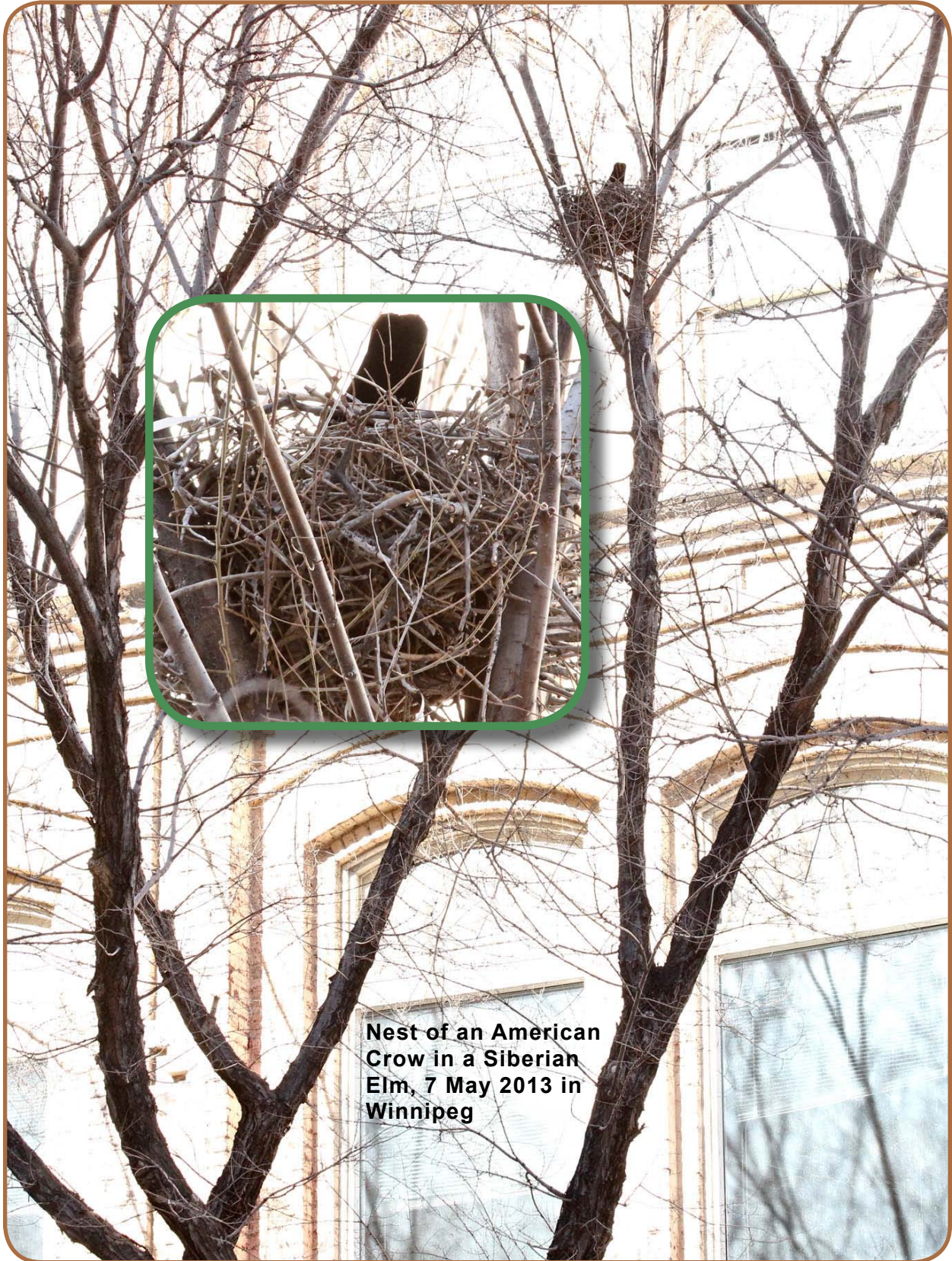


The Breeding Season



**Nest of an American
Crow in a Siberian
Elm, 7 May 2013 in
Winnipeg**

THE BREEDING SEASON

5

The early February countryside has taken on a stark, hard-edged design. The snow could go on forever, but for the line of dark trees dividing the canvas.

At my feet are small blue shadows that crisscross a snowfield, revealing the white blanket not to be as smooth as imagined. The low creeping movement of the winter's sun stretches the shadows far but not wide. Near a cedar fence, faint footprints left by a flock of Snow Buntings will vanish with the next tug of wind. Turning back towards the road, I realized I have not seen a crow all day. The gliding signature of its blue shadow is a delight I will have to do without, at least for now.

When February arrives and crows are assembling on the ground near a large wintery roost, you may notice several “mock” fights between pairs of birds leaping a meter into the air. It may be play-fighting by yearlings, or more serious stuff as adults feel the internal surges of spring. Fueled by lengthening days and increasing sexual hormones, this stepped-up aggression could be the underlying cause for the demise of winter roosts. The crows can no longer tolerate each other.

Ceremonial gatherings

By late February the first returning black-shirts signal the genesis of spring. Crows are arriving in southern **Ontario** to begin their breeding season. Resident urban crows become more active and vocal on their permanent territories. Overhead, where angels sing and dance, flights of fancy are happening. Crows gather in small, noisy flocks throughout the day. Because these flocks occur in the spring, February through May, it is a reasonable assumption they are part of courtship, territorial acquisition, or

another social ritual we may never understand.

For the Black-billed Magpie (*Pica hudsonia*), these vernal flights are called ceremonial gatherings. One or two non-territorial, paired or unpaired, non-breeders but high ranking magpies (floaters) were the initiators. Solo initiators were males. The ceremonial gatherings lasted about 10



In **Winnipeg**, Crocus Anemone is an early sign of spring. Crows arriving from the south is another

minutes to over an hour and averaged 9 (3–24) birds. It was thought 35% of territories were obtained from ceremonial gatherings 13b.

My field notes in Guelph **Ontario** for March 1987 indicated 21 gatherings averaged 9 (3–19) loosely bunched American Crows, with a late May group of about 30 birds. The size of a flock was constantly changing as it traveled in a circuitous route above the trees. Two or three front birds may touch, and flying higher and higher, leave the others lagging – actions suggesting courtship. Sometimes a gathering settled in trees, on the





ground, or a rooftop. Two gatherings may be viewed simultaneously. As a gathering sailed by, pairs of crows left their ground-level territories and joined in. For example, a pair plus a helper, flew west 200 m to join a ceremony of 12 crows, stayed with them for almost seven minutes, then returned from the east. Another pair of crows stopped their nest-building, joined four ceremonial birds for one minute, then returned and resumed nest-building. On two occasions, a pair of crows locked violently in the air, fell about 30 meters, then separated before hitting the ground. Were two males fighting over a female or a territory? We do not know.



A spring gathering on 16 March 2012 in **Winnipeg**. Much cawing, flying, and pausing are necessary. Crows perch in trees or on buildings. Some families are already building a nest

A green carpet of grass
Stretches to infinity.
The passersby do not care
That spring is about to end

– Ou-Yang Hsiu r47

Cooperative breeding

Early crow watchers often saw triads of birds and mistook this as proof against monogamy. Similar to matings by Canada Geese, American Crows are mainly monogamous – the pair remaining together for life, unless life gets in the way.

A social and intellectual development in cooperative animals is necessary. Nicholas Humphrey introduced the Social Intelligent Hypothesis (SIH) based on his work with Rhesus Monkeys. Some of the latest figures indicated species that formed life-long pair bonds, such as corvids and parrots, tended to develop the largest relative-sized brains. Canada Geese may also can have a life-long pair bond. Yet they have relatively smaller brains. Part of the reason might be in their social and nesting posturing. The young of geese are precocial and feed on their own within hours of hatching. The parents do not engage in allopreen-

ing or allofeeding, etc. It appears the pair bond is “more socially and cognitively complex in corvids and parrots than in geese and albatrosses.” Working with 480 species of birds, the group with the relatively largest brain size were those that formed small groups of 5–30 birds and bred in a cooperative manner, as do the corvids e34. Recognition of family units among some crows and other birds forced us to try and explain this phenomenon.

Each member in a family / group of birds develops a particular status. For relatively tame Florida Scrub Jays, *Aphelocoma coerulescens* (28 cm), in Highland County **Florida** that had a permanent territory and bred cooperatively 38w –

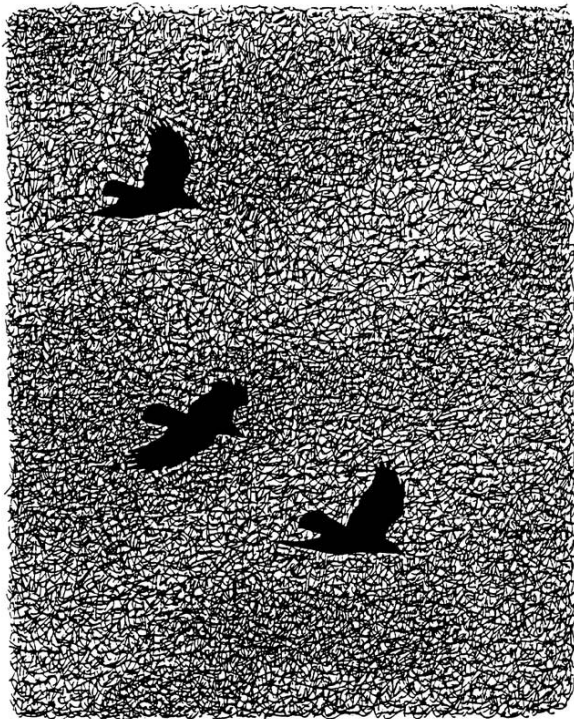
- (1) the male breeder dominated all other birds in the family
- (2) male helpers dominated all females
- (3) female breeders slightly dominated female helpers
- (4) juveniles created a hierarchy among themselves over the first summer
- (5) the dominant male helper was usually the first to depart and take a mate when the time was suitable
- (6) conflicts within a family were rare

Cooperative breeding is possible because individual crows, as least in the family, recognized each other in vocal, sexual and age-related ways.





Researchers worked with 11 Large-billed Crows, *Corvus macrorhynchos*, in Tokyo and Tsukuba **Japan**. Audiovisual, cross-modal individual recognition was tested by using an expectancy violation paradigm. An expectancy violation theory attempts to explain peoples' reactions to unexpected behavior. "The crows looked through an opening for a longer time and with a shorter latency when the identities of the visual and auditory stimuli were familiar to them but incongruent, than when they were congruent." When the stimulus was not familiar (a call), the above behavior did not occur. The Large-billed Crows cross-modally recognized group members, but not non-group members 05k.



A pair of breeding crows with a helper above

Two fashionable theories

- (1) The habitat saturation theory may explain the development of cooperative breeding groups in crows. The habitat is saturated and the young have no place to set up a territory, so they stay with their parents for varying lengths of time (years for some)
- (2) The alternative theory is that birds remain at

home to improve their fitness benefits. It appears local patterns of variation in the quality of individual territories may explain the evolution of both types of breeding ecology 35s.

Among American Crows and other corvids, a breeding pair may have a helper(s) one year but not the next. And quite possibly, one breeding pair in a city may have several helpers, while the adjacent breeding pair may have none. Are these urban territories so vastly different in quality as to exhibit such a high difference in the number of family members? Or are the personalities and social abilities of the parents and young involved?

Learning to help

A gathering of 39 eggs came from 17 nests of Carrion Crows in rural **Switzerland**, where there was no cooperative breeding (no helpers). Once these incubated eggs started to hatch, the nestlings were placed in nests of Carrion Crows in northern **Spain** where some of the crows did practice cooperative breeding (helpers present). The transplanted nestlings were marked and then fitted with a radio transmitter prior to fledging.

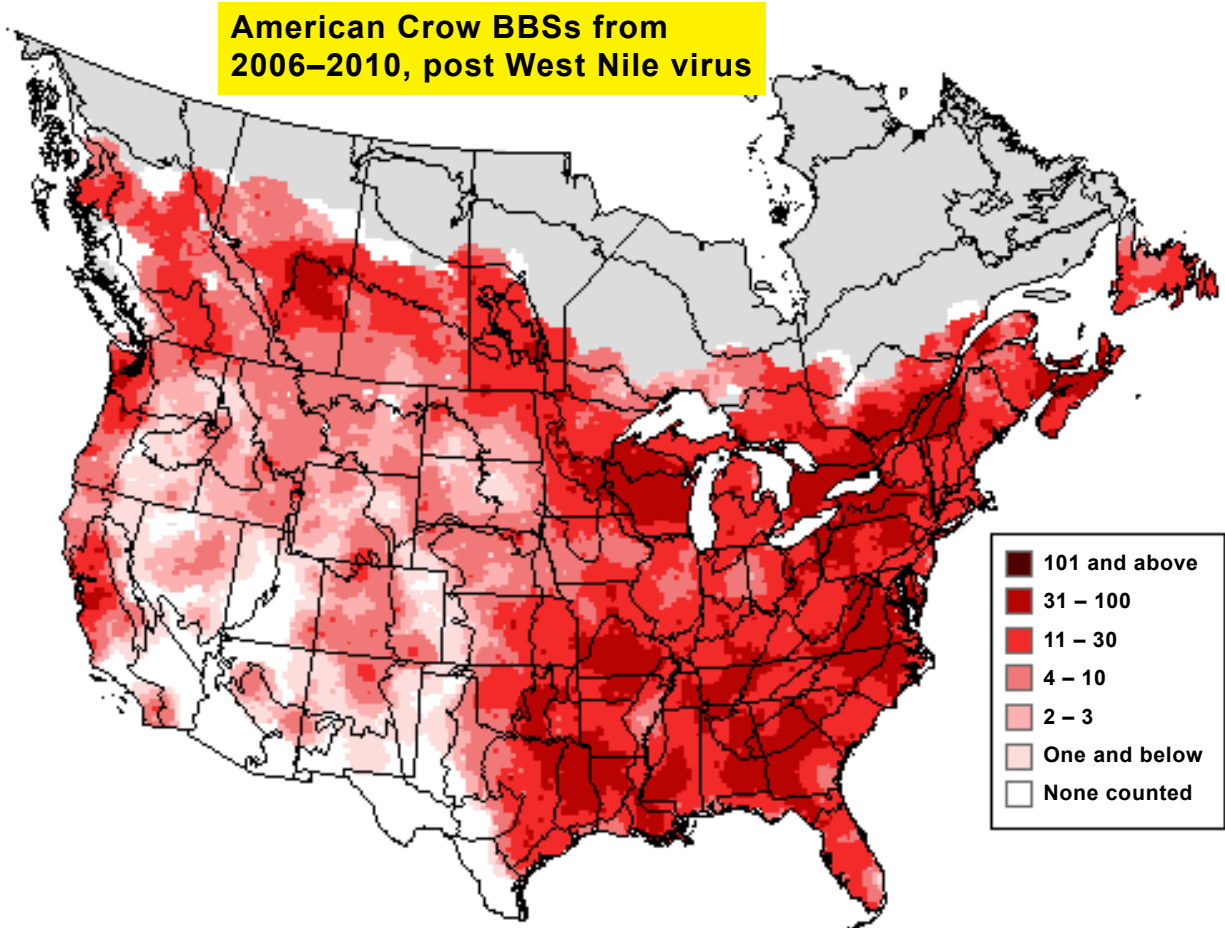
The nestlings that remained in the donor nests in **Switzerland** were also banded. As the next breeding season arrived, none of the banded juveniles were found on their parent's territory in Switzerland. That was expected.

In **Spain**, however, only one of the 7 surviving transplanted juveniles left its natal territory by the end of the summer. Into the next breeding season 5 Carrion Crows stayed on their foster parents' territory. Two of the transplanted female yearling crows helped to feed nestlings in their new parents' nest, and defend their nest and territory. One other transplanted female crow eventually left due to nest failure. Two males were pushed to the edge of their parents' territory by the dominant breeding alpha-male.

The experimental transfer of nestlings responded as predicted "non-cooperative Carrion Crows of **Swiss** ancestry can express delayed natal dispersal and helping behavior when reared in a cooperatively breeding population of the same species in **Spain**." The rearing environment can influence social behavior b06.

A comparison was made between breeding





43. American Crows have survived the first decade of contact with WNV. Summer distribution of the American Crow, in Canada and the United States, based on Breeding Bird Surveys from 2006–2010, a post West Nile virus era. The BBS is a cooperative effort between the U.S. Geological Survey's Patuxent Wildlife Research Center and Environment Canada's Canadian Wildlife Service to monitor the status and trends of North American bird populations. Each year during the height of the avian breeding season, June for most of the USA and Canada, participants skilled in bird identification gather population data along roadside survey routes. Each survey route is 24.5 miles (39 km) long with stops at 0.5-mile (800 m) intervals. At each stop, a 3-minute point count is conducted. During the count, every bird seen or heard within a 0.25-mile (400 m) radius is recorded. A survey starts 30 minutes before sunrise and takes about 5 hours to complete. Over 4,100 survey routes are located across Canada and the continental United States. <http://www.mbr-pwrc.usgs.gov/bbs/ra2011/ra04880.htm>

habits of Carrion Crows in **Spain** and **Italy**. In Spain breeding pairs occupied their territories year round, and apparently offered a relative safe and stable place for offspring to hang and help along the way. In Italy, the breeding pairs abandoned their territories after nesting, which encouraged their young to disperse. This new finding does not support the habitat saturation theory whereby young stayed with parents due to a lack of available vacant territories b07.

Helpers

In the 1800s to the early 1900s, crow watchers did not understand the social organization of a crow's family f56, 20b, g34. Today, we know one or more extra crows with the breeding pair are probably related yearlings or adults. They are referred to as helpers, or auxiliaries. Birds that partake in cooperative breeding are in the minority. About 3.6% of birds, or 348 of 9,672 species





develop family groups that involve cooperative breeding l42.

“Cooperative breeding in birds is a reproductive system where more than two individuals provide care to the young” b05. The mated pair often stay closer together with the third or fourth birds to the side. Trios of crows have been seen from **New Hampshire** to **Florida** over the fall and winter k53. For two familiar, non-migratory wild crow families in **Florida**, their cooperative groups averaged 7 (4–10) crows over several years. Beyond the two breeding adults, the two groups included 4 (2–6) non-breeding adults and 1.4 (0–4) yearlings k47.

Before we go further, several categories of crows should be explained –

(1) **Nestlings** – young altricial crows in the nest

(2) **Fledglings** – crows that have recently, permanently left their nest-tree but remain in trees. After 7–14 days they are strong enough to join their parents on the ground as juveniles, where they will be fed until they learn to feed themselves. Another definition was the period from leaving the nest to the end of parental care s87. For crows, this may be a long and variable period of time, and it is difficult to judge when parent crows stop caring for their young. I have used a shorter time frame of 1–2 weeks

(3) **Juveniles** – (HY) Hatch Year birds feeding on the ground, some of which remain on their parents’ territory until the end of our calendar year (31 December of their hatch year). Juveniles are fed for 1 to a few months by their parents over their first summer and possibly into autumn

(4) **Yearlings** – birds from 1 January throughout our next calendar year; After Hatch Year (AHY) or second year (SY) birds. They may disperse or remain with their parents as helpers or auxiliaries. Sometimes called Subadults (sub-A). Generally birds that have not yet acquired their own territory and breeding mate, because they are not yet sexually mature

(5) **Mature** – (Ad) Adult crows entering their 3rd summer or second full year; breeding is possible although they will not actually be 2-years-old until the time when they hatched two years ago, probably sometime in March–April. Some crows do not breed until their 3rd year or beyond

(6) **Auxiliaries** – crows of different ages that stay with the breeding pair on their territory for various lengths of time (months to years). They may help with guarding the territory, mobbing predators and feeding nestlings. Most, but not all auxiliaries are helpers; but they still have a presence and interact with the family group

(7) **Helper** – a yearling to an adult crow several years old. Usually not interchangeable with related yearling since not all yearlings are helpers and not all helpers are yearlings. Related or distantly related helpers may also be adults. Helpers can be either sex and are the foundation of cooperative breeding. Some male helpers (even sons) may mate or try to mate with the breeding female. Immigrants from other families (often males) may also become a helper and try to, or breed with the paired female. Female helpers are not known to breed with the paired male. Helping is an option to dispersing and breeding on their own, or so we think.

A helper is “a bird which assists in the nesting of an individual other than its mate, or feeds or otherwise attends a bird of whatever age which is neither its mate nor its dependent offspring. Helpers may be of almost any age; they may be breeding or nonbreeding individuals; they may aid other birds



A pair of crows without a helper in **Winnipeg**





of the most diverse relationships to themselves, including those of distinct species; and they may assist in various ways” s87. The American Crow may have helpers as part of the family unit.

R Tarter concluded helpers provided three benefits to families –

- (1) helped in territorial disputes and interactions between other families
- (2) increased the possibility of finding a windfall of food
- (3) an early warning system of dangers or predators

Generally, male crow helpers assisted with disputes between families. Female helpers often acted as sentinels, which may have increased adult feeding times t07.

How and why cooperative breeding developed is still under discussion – population regulation, altruism, group selection and queuing for territory are a few of the current ideas w92. There is support in field work for each idea. But it is necessary to develop fruitful comparisons between species

with and without a cooperative breeding strategy r71. Although helpers (non-breeders) appear maladaptive in their behavior, the provision of relatedness, current costs and benefits, and sources of genetic variation may all add to the adaptive nature of helping 46w.

Helpers come from 3 sources –

- (1) offspring of the breeders
- (2) siblings of the breeders
- (3) immigrants into a social group

Helping is the only alternative to leaving the natal area and eventually breeding independently. Helpers may increase the number and quality of nestlings fledged.

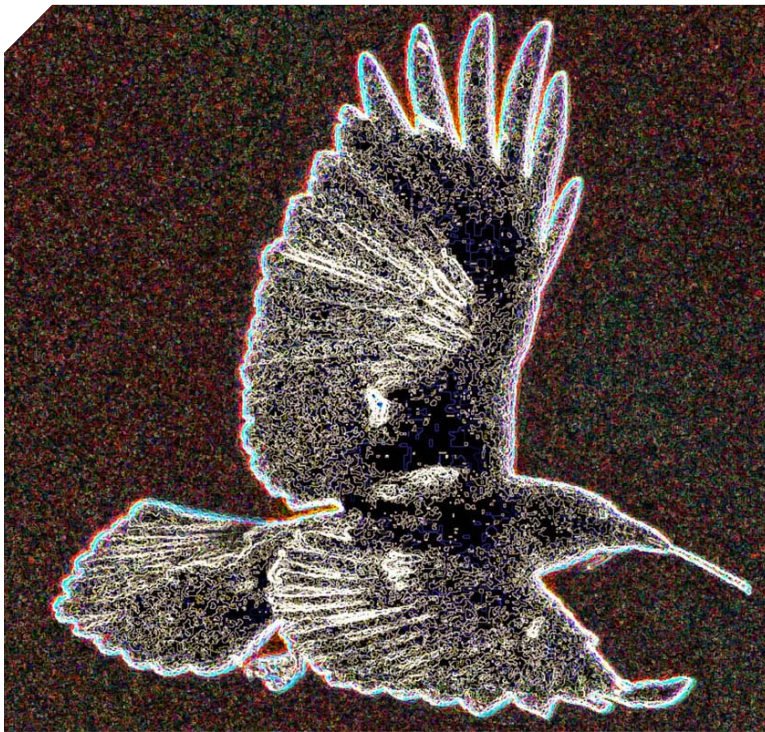
Then there is the endangered Red-cockaded Woodpecker, *Picoides borealis*, in the south-eastern **United States**. As cooperative breeders, their helpers gain indirect fitness benefits by helping their parents raise related offspring. This translated into increased longevity of the breeders (their parents). With helpers present, the risk of male breeders dying dropped 21–42%. For

females, it was a 0–14% reduction, possibly from reduced workload or enhanced predator detection. For other species, when helpers were present, the breeders often reduced their workload, but not always. Helpers may help very little with caring for nestlings, or not at all.

There is speculation the inexperienced young might be taken more easily by predators, thus allowing the parents to survive. Or, some breeders producing more young were naturally top-quality birds that were normally long-lived k37.

Some avian characteristics suitable for the evolution and maintenance of a helper system 36w –

- (1) a population of long-lived birds
- (2) permanent monogamy
- (3) a continuous territory with one brood each year within a short synchronized nesting season



Nest building is one chore some helpers engage in to assist the family and learn their culture





Red-winged Blackbirds nest in cattail marshes and the males chase crows passing over their breeding territory

American Crows are a good fit.

A color-marked, rather tame population of Florida Scrub-jays was studied for over 20 years in **Florida**. The birds were cooperative breeders and almost always monogamous. DNA confirmed the behavioral parents were the genetic parents ^{q03}. For this jay, the stepfathers were more aggressive to male prebreeders, and stepmothers to female prebreeders, than were their natural parents toward the prebreeders of the same sex, which supported a dominance hypothesis. Furthermore, stepfather jays caused male yearlings to leave their home territory (disperse) more often than they did older helpers ⁹³¹.

For a breeding pair of Fish Crows in **Clemson South Carolina**, the auxiliary was usually kept away from food at cache sites during the nesting season, 12 April to 14 June 1984 ^{06m}.

From 25–50% of families of American Crows had an auxiliary that joined from other groups of crows (from Caffrey, unpub. data) ^{h06}. Non-breeders may move about various territories, visit their parents, or move in with other nearby groups. Consequently, the group size of a family may change hourly to annually. The benefits vary according to the sex of the helper. Generally males are more likely to stay and help, directly or indirectly. Helpers may also help because of certain personality traits ^{r97}.

The dominance of an unmarked breeding male was observed at close range by Kilham in

southern **Florida**. Early in the breeding season, (January), when the semi-tame family of 8 birds came to feed on corn he scattered, the larger male did most of the cawing and tail-flicking, and was the last bird to feed. When feeding he kept trying to edge out another crow Q, also thought to be a male. On 14 February, the dominant male supplanted Q from 9 fence posts in succession. At other times the male simply positioned his body between his mate and a yearling, or with more intent, pecked at the yearling's feet. A yearling might assume a begging posture to reduce tension, or hold out a foot to keep the breeding male away. During the late incubation period the aggressiveness of the dominant male declined. Kilham suggested displays of male dominance

maintained cooperative breeding and reduced the size of the family group in the spring ^{k53}.

Kevin J McGowan, with the help of several students over the years, marked and studied crows in Ithaca **New York** for over two decades. Males did not breed independently until at least their third year and females in their second year ^{t63}. The presence of helpers in family groups varied. Helpers were at 60% of 62 rural nests and at 80% of 299 urban nests of crows. The average number of helpers per nest was 3.7 in the city and 3.2 in the country. The number of families with more than 6 helpers was slight, although up to 12 helpers was possible in the city. From 2001–2005, after the arrival of WNV, the percentage of families with helpers dropped. Some auxiliaries delayed breeding for up to 6 years. Overall, nesting crows were more successful based on three interrelated variables –

- (1) presence of helpers
- (2) early nesting
- (3) consistent differences among breeding pairs: 2.1 fledglings with helpers; 1.9 fledglings without helpers ^{m85}.

In **California**, having helpers and nesting early were independently tied to nesting success. Breeding crows had one helper 86% of the time, and two helpers at 14% of the 35 instances when





helpers were present ^{c13}.

During a 5-year study on a golf course in **California**, crows averaged a breeding density of 0.8 pairs per hectare. Using cannon nets and large walk-in traps, 173 crows were caught, then marked with patagial wing tags and leg bands. Disturbances to these breeders and predation chiefly by Great Horned Owls, lead to a nest success rate of 43% (63 of 147 nests). For successful nests, the mean number of fledged young was 1.9 per nest ^{c11}. At 35 nests where helpers were present, 81% of nesting attempts fledged crows while only 32% of nests without helpers fledged young. From this it appeared that helpers were useful to have around as far as nesting success was concerned. Second or renesting attempts in the same year (n 24) failed to produce any young ^{c13}.

The 173 marked crows consisted of 54 females, 63 males, and the other 56 were not sexed. From 115 breeding pairs over 1985 to 1989, 37% (28–57%) had auxiliaries (helpers and nonhelpers) and 30% (25–47%) had only helpers. Most auxiliaries (78%) were yearlings and 61% of the sexed auxiliaries were females. And 82% of auxiliaries helped the breeding pair, except with nest building. Of sexed helpers, 72% were

females. Helpers ranged from 1–3 birds with one helper present the majority of times. Auxiliaries ranged from 1–5⁺ birds with one auxiliary the most common number. One breeding female, at least 5 years of age that lost her mate, joined another family as a helper ^{c09}.

At the golf course, all 15 yearling females stayed on their natal territory and 9 of 14 (64%) of yearling males did the same. Overall, 27 auxiliaries marked as nestlings stayed with their parents, or at least in the natal core area. In a review on avian dispersal, it was usually the female that left the natal area and traveled a longer distance to breed than the males, but this pattern was obviously not fixed for the crow ^{c76}. Non-helpers as well as helpers begged and were fed by the breeding pair, especially by the male bird. Non-helpers stayed in the core area of the breeders territory, but were not seen near the nest.

Another interesting aspect of the golf course study in **California** was the few territories that went empty were not immediately filled by crows of breeding age looking for a territory in which to nest. In this colony of nesters there was much overlap of territories and little aggression. New breeders simply squeezed into a small space and built a nest. With empty territorial spaces, the

28 May 2011. Two blue-eyed nest mates will soon fledge from a Colorado Spruce. The same nest was used successfully for several years in **Winnipeg**. Helpers were never observed at this productive nest. General view of area in the photograph on [page 48](#)



The Breeding Season



theory that lack of breeding space was one cause of delayed breeding by the crows did not hold in this situation. It may be dependent on more social aspects of the flock and individuals. “The first breeding attempts of 8 males and 6 females all were unsuccessful.” Each crow may delay its breeding until it decides it is time to breed.

Among 40 marked breeding pairs with auxiliaries, there were –

- one auxiliary 75% of the time
- two auxiliaries 20%
- three auxiliaries 5%

50 aged auxiliaries yielded –

- one-year old 78%
- two-year olds 14%
- three-year olds 4%

four-year olds 2%

older than 5 years 2% (a widowed female that bred the previous year) c09.

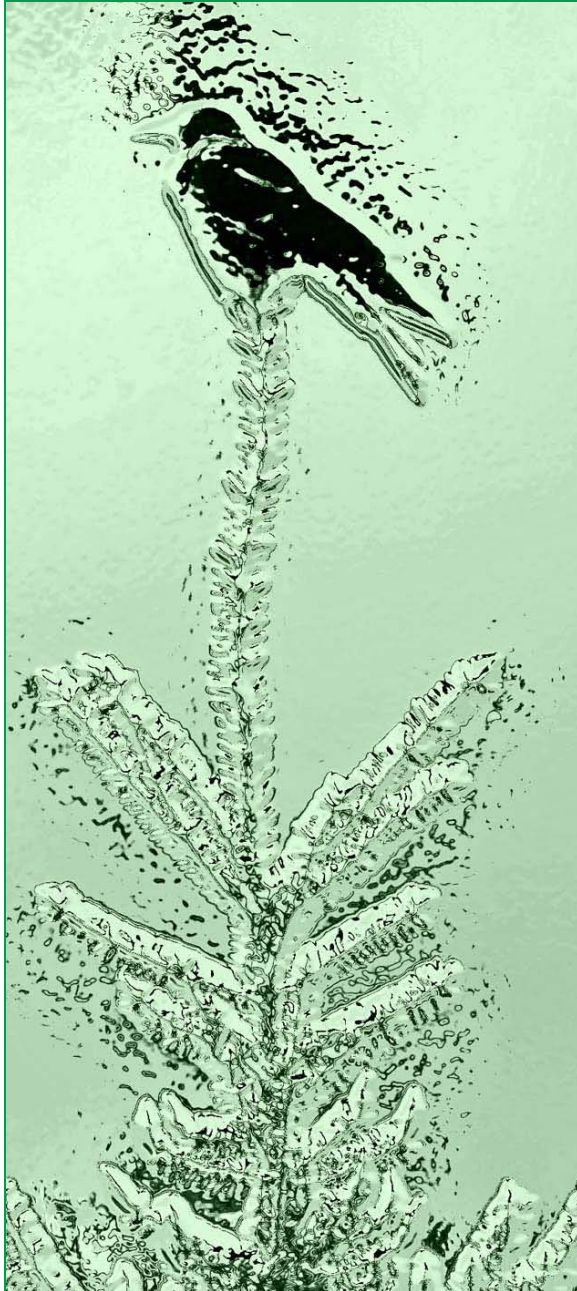
On the golf course, the annual mortality of 62 marked male breeders was 7% (0–14%) and for 29 marked females 3% (0–20%). Over five years, the survivorship was 93% for the males and 97% for the female breeders. Only one female breeder died; it was hit by a golf ball. Of the 4 male breeders that died, 3 were found dead and the 4th was missing and presumed dead.

Young crows did not fare as well as the adult breeders above. In all, 71% of the fledgling crows survived their first 2 months. And about 68% of all fledglings lived to be one year of age. Young crows had various dispersal options from the natal area, including when they left. Some left in their first fall as juveniles, but about half of these



One of the most successful nests (arrow) in **Winnipeg** was built in a planted Colorado Spruce in a cluster of similar trees. The territory of the 2 crows had plenty of lawn for feeding on worms, insects and mice. A light pole and cottonwoods near the nest were perches for the sentinel crow. I never observed any helpers at this nest. The crows restored their nest each year. This pair nested early and their young fledged during the first few days of June, the earliest in my study. Their territory was within the territory of a Peregrine Falcon. Where are the corn fields?





returned home as yearlings for the next breeding season. Most juveniles stayed on their natal area until at least January, at which point (by our calendar) they became yearlings. Overall, 55% of marked juveniles spent their first 12 months on their parents' territory; some stayed much longer. Others joined the local non-breeding flock c09.

In Stillwater **Oklahoma**, cooperative families were comprised of 2–12 birds and included four age groups. Some auxiliaries moved in from other

families, and not all auxiliaries helped v18. The day the first egg hatched, feeding trips to the nest began. At 23 nests over two years, an average group size of 3 (2–5) breeders and helpers fed the young. Breeders varied from first-timers (11%) to more experienced birds. One male breeder with an injured leg contributed only 6% of the total feeding visits. From 32 helpers in the two years, 37% were females and 53% males. Only 53% of the helpers were offspring of the breeding pair. Helpers from neighboring territories joined the family groups h06.

Family groups ranged from 2–10 birds at Cape Cod **Massachusetts**. Yearly means of families ranged from 3.5 in 1983 and 1984, to 5.7 in 1987, with 4.4 birds the overall mean size. The most common group size was 3. At 54 nests, 94% had one or more helpers, and the offspring stayed for the whole year. When three separate breeding pairs without helpers successfully raised a family, the young remained on their parents' territory for at least 4 years. Helping included shared incubation and brooding several times in the two largest family groups. Urban family groups with 4 or more experienced helpers tended to produce more fledglings. It seemed inexperienced helpers did not try, or were not permitted to help with the chores. They watched to learn their culture c56.

In Guelph **Ontario**, in the 1980s, I estimated about half the unmarked breeding crows had helpers. At **Winnipeg**, while monitoring 47 nests of American Crows in 2008 and '09, I estimated 10% of the unmarked breeders had easily observed helpers during most visits to their nesting territories. Three helpers was the highest number counted near a nest. Two years later I noticed a group of 6 crows associated with a nest in Winnipeg. It is not known how many migratory pairs of crows retain helpers. A study of crows nesting in rural **Saskatchewan** made no mention of helpers i04. Some of the unmarked urban crows in **Winnipeg** maintained a year-round territory. It would be interesting to know what percentage of urban crows remained year-round on their territories compared to rural breeding crows on the prairies, and how this influenced the number of helpers per family.

On two islands in **British Columbia**, 138 nests of Northwestern Crows were located. 18%





American Crows nested successfully in a planted spruce tree near the Millennium Library in **Winnipeg**. Close up (right) of her tail as she incubated

of the breeding pairs had one helper and always a yearling v09. Assuming helpers were associated with food-rich territories, the question arose, which came first – a territory with an abundant food supply that permitted a helper to remain, or the presence of a helper that allowed the three birds to control a territory with a rich food supply?

Two non-migratory families of unbanded crows in **Florida**, had 3 or 4 yearling helpers and adult helpers at two nests. k47. Even when crows migrated, they often returned to or near their natal home. Analysis of band recoveries showed American Crows of all ages were most likely to return to the same county or an adjacent one in subsequent nesting seasons 934. Some may decide to become a helper as a yearling.

What a helper may do has been catalogued k47. Yearling (AHY) helpers assist with –

NEST building

FEEDING a female while she is incubating

CARING for and feeding nestlings

CLEANING and defending the nest

DEFENSE against raptors

Regarding defense, helpers also acted as sentinels, especially 2-year old helpers 08w. The presence of one or more helpers on a territory may serve as a visual deterrent to other crows or predators. Birds that help may derive benefits by increasing the productivity and survival of their parents. Being with a family group may ultimately increase their own survival and future breeding success through an increase in personal status and knowledge h06.

Over her 5-year study on a golf course in Encino **California**, Caffrey found helpers never helped with nest-building. Consequently, she defined helpers as those auxiliaries that helped to feed the nestlings. Helpers fed fledglings, guarded nestlings and fledglings, and helped with nest sanitation. Some crows that stayed more than one year with the family group did not help every year. c09. Again, each crow develops a status and personality which are reflected in its behavior.

In **Florida**, adult helpers were kept away by the dominant breeding male during nest-building through incubation, but were permitted to help after nestlings appeared. Yearling helpers assisted with nest building, fed the female while she incubated and brooded, then fed the nestlings. k47. Near the nest (within 90 m) and while it was





American Crow A newly built nest in an American Elm covered with snow in April, then abandoned

under construction, an inner group of four crows (breeding pair and two yearlings) were present. Further away, at 200 m, seven crows fed on the corn scattered by Kilham. The extra crows were of adult age and non breeders ^{k53}. When a crow helping at a nest disappeared (or died), the event usually caused an adjustment in the behaviour of another remaining family member regarding its helping (feeding) efforts ^{h06}.

Outside Arvidsjaur **Sweden** (65° N), Siberian Jays, *Perisoreus infaustus*, were fitted with radio transmitters. Their dispersal behavior was monitored. Fledglings delayed dispersal, with the most dominant ones of both sexes, most likely to stay with their parents ^{e24}. After the experimental removal of breeding fathers in the summer, the retained offspring dispersed at various times, whereas the unrelated extra birds in the family group remained. "By blocking immigrant and unrelated males from becoming alpha-males and by being tolerant themselves, fathers provide a 'safe haven' in the natal territory where retained offspring can avail themselves of available resources without any, or only mild, competitive interference" ^{e25}.

Considering the many chores helpers of American Crow may do, they are not often seen doing them. Helpers vary in how helpful they are and some can exhibit a lack of interest. At some nests I visited weekly in Guelph **Ontario**, a helper was present each visit; at other nests, the helper

was rarely seen. Even though nest-building is one activity I saw helpers doing, at the same time I've witnessed rather feeble attempts by them at gathering nest material on the ground. However, in **British Columbia**, a Northwestern Crow helper had a real spark. It took on the job of feeding the nestlings and did so diligently, averaging 50 minutes between nest visits ^{v09}.

Even though helpers ate some of the resources on their parents' territory, and occasionally were fed by adults or driven away by the dominant male by close positioning, in general each member of a group or family had a status based on their abilities, and each helper had to test itself to determine how it fit in, if indeed it did at all. The benefits provided by helpers were apparent on the bottom line ^{w92}. Pairs of Northwestern Crows with helpers raised 2 compared to 1.2 fledglings per nest without a helper ^{v09}.



Courting calls and other sexual traits

On this mild March morning, I am enveloped by the sounds and sights of a surging spring. At latitude 43° N, the warming air is saturated with the promise of blossoms. Plant buds are enlarging and rivers are running high. The swirling brown water captivates.

Tuning my ear to the delicate sounds of nature, I have grown to expect bouts of soft notes from American Crows at this time of the year. Repeated two or three times and possibly followed by a click, I assumed this was one of the typical courting calls from a crow. Not lasting more than about four seconds, a bout may carry 60 m or more. Although the call was soft and easily covered by sounds of passing vehicles or yapping robins, the head bowing of a crow was the best signal that something fundamental was going on. Initially the neck was extended and the bill pointed down. When a crow was perched on a branch, its bill often dipped below the level of its feet as the throat and neck feathers were raised. As the bill was pulled toward the chest and raised,





a soft cu-koo sound was emitted. At the same time the wings were usually pumped out from the sides and the tail fanned.

A mated pair perched several cm apart bowed together while facing in the same direction. At a ranch in **Florida**, a pair perched on the back of a cow and did some bowing. One crow then tried to mount the other. Kilham also noted the dominant breeding male, which fed at scattered corn, bowed and gave the cu-koo note with tail spread and wings slightly extended. In context, a rival male was nearby ^{k53}.

I believe head bowing is performed every month, but is more frequent and with louder vocals in the spring. The ritualized bows in other months appeared to be made with little or no production of sound, at least none I could hear. Juveniles 2–3 months old can give bows, but again with little vocalization. Most of the courting calls in the spring took place before noon, but then most of the crow watching I've done also took place before noon. Twice in the spring, soft twittering notes were made half an hour before sunrise. In one instance they were the first calls of the morning before a crow left its pine tree roost in **Guelph**.

The soft cu-koo notes occurred when a crow was alone, with its mate or family nearby, or even among an assembly of crows in the evening. Sometimes both paired adults gave bows and soft notes when perched together. At other times, while one crow delivered its vocals, its mate, as close as a body-width away, appeared not to notice. These soft calls happened when a crow was perched or walking, but not when flying. The bowing appeared unexpectedly, at least in my interpretation. Whether a crow can feel it coming is surely something that should be left with the bird. For example, in March a crow was filling its bill with lawn grass as nesting material when the bowing began. The grass fell from its bill. When the two bouts were over, the fallen material was ignored, and the crow began gathering new grass. Bowing appears to be trance-like for the crow.

From a 1920s account of the crow's courtship by Townsend, "A Crow, presumably the male, perched on a limb of an oak tree, walked towards another and smaller Crow, presumably the female, that seemed to regard him with indif-

ference. Facing the smaller one, the male bowed low, slightly spreading his wings and tail and puffing out his body feathers. After two bows, he gave his rattle song, beginning with his head up and finishing it with his head lower than his feet. The whole performance was repeated several times" ^{t72}.

In **Florida**, bowing crows emitted a cu-koo note in both a courting and an aggressive context ^{k53}. Kilham did not mention the twittering notes that Guelph's crows make more than any other courtship sounds. Although the cu-koo note was popular in the spring, I once heard it from a crow among thousands at the Chatham **Ontario** roost one morning. Kilham ^{k53} described other courtship delights –

- (1) bill tips gently rubbing together and one crow "grasping the terminal half of the bill of the other"
- (2) low notes exchanged between mated crows on their nest prior to egg-laying
- (3) a G-dong vocalization



An American Crow bows and makes soft sounds in the spring





“A hoarse rattle” was the delightful phrase Allen used to illustrate the crow’s spring call ^{a15}, and Townsend agreed: “The courtship song of the Crow consists of a rattle, a quick succession of sharp notes which have been likened to the gritting of teeth.” Positioned below a crow’s nest, Townsend heard the rattle note 54 times, often followed by pleasing liquid sounds, softer than the cooing of a pigeon ^{t72}. Eventually, he devoted two pages in a journal to describe the cooing notes of the crow ^{t74}.

During one August in **Guelph**, at 20 m distance and lasting three minutes, I enjoyed 27 bouts of rattle notes, each about a second long and composed of 4–6 distinctive clicks. Some twittering calls were also made. When giving the harsher rattle notes, the crow’s head was held out and slightly raised, while the tail jerked up and down. What may have been a variation of a rattle note became part of my experience one spring day. For two minutes and at no set interval, loud rapid metallic clicks, 6–12, together with 20 softer notes competed with the wind.

finally, I have to agree with Kilham who wrote: “With American Crows it is possible to miss much that goes on in the way of courtship unless one studies them at close range and in the absence of [their] fear” ^{k53}. I suspect crows speak in soft murmurs and whispers, which neither I nor anyone else has heard or described. Contrary to public opinion and knowledge, the vocal range of the crow is glowing, subtle and virtuosic – it deserves a kind and deliberate ear.

Allopreening

Another courtship or pair-bonding activity that crows engage in throughout the year is allopreening. It has been suggested allopreening may actually stem from inhibited aggression due to “the enforced close proximity of two individuals.” It was pointed out that for species with similarly colored sexes, allopreening was common. Yet, for the majority of birds, this type of preening is not done. Why has this behavior not spread throughout the avian world? Allopreening is usually confined to the head region – those feathers that a bird cannot reach on its own. There is no alternative to allopreening for birds that don’t practice it ^{h37}. As a clarification of Harrison’s suggestion above, both Kilham and I, from generous observations, believed allopreening is a part of pair-bonding and not a repressed act of aggression. The main reason is that both sexes seek allopreening ^{k53}. Furthermore, in response to Harrison’s suggestion that there is no alternative to allopreening, crows perform three individual functions directed specifically at the head that may be a partial, but less endearing substitute. There is scratching the head with their toes, rubbing the head vigorously against a branch, and snow-bathing (including diving headfirst into a snow bank).

Within the genus *Corvus*, several members were listed as allopreeners ^{h37}, ^{k53}. With the American Crow, the bird being preened does not usually reciprocate during the initial event. Spring is the best time to observe allopreening. From several bouts in March 1987, the format developed this way. The crow wanting to be preened





moved toward its mate (the birds were usually perched above the ground). Often, if one bird was preening itself (autopreening), its mate seized the opportunity and presented itself at close range,



A crow allopreens the head region of another crow, probably its mate

a body-width away. Once situated, it lowered its body and neck, and remained sculpturally still for several seconds. One crow went about this posturing in a different way. Remaining upright, it bent its head down and to the right, indicating the back of its head or neck was in need of preening. Another crow pushed its head underneath and against its mate's side as a hint that more preening was desired. Kilham saw a female crow gently preen the top of her mate's head, then lift his bill with hers in order to preen his throat feathers. When she preened around his eye, his *membrana nictitans* (white nictitating membrane) was closed. On the ground, a breeding female stood on a cow pie to reach and preen the top of her mate's head. While incubating, she tried to preen a yearling that brought her food. Standing on the nest's rim, she preened her mate when he brought her food. When she resettled on the eggs, he allopreened her k53.

A bout of allopreening usually lasts a matter of seconds or perhaps a few minutes. When

the active crow doing the preening wanted to stop, it simply walked away, or flew to another branch. But this may not be far enough. One crow of a pair hopped and shuffled sideways along a branch after its mate for five minutes, trying to solicit its attention. Over this period, it was preened about the head for only three short bouts. During one session, the bird preening its mate had its bill slightly open and made soft jabs and pushes into the head feathers. One quick swallow was noticed, which supports the theory that ectoparasites are sometimes removed through allopreening. In 29 bouts of allopreening among couples, a third crow tried five times to interrupt k53.

From marked birds at Ithaca **New York**, female breeders allopreened male breeders, but not the male auxiliaries in a family group t63. In Guelph **Ontario**, a 7-week-old juvenile crow approached a preening adult, and when the chance arose it preened the top of its parent's head repeatedly for almost 2 minutes. This was unusual because the parent did not present the standard position that indicated allopreening was desired. Occasionally, soft, single caws attend the session, but normally it was a quiet moment between two crows k53. Kilham watched a breeding pair fencing with bill tips and even grasping each other's bill (billing) k63.

What best illustrates the gentleness of allopreening was the experience of Lorenz, who trusted his eyes to the vital nature of his pet raven. Holding his head near that of the bird's, the raven "with wonderful precision, submitted every attainable hair [eyelash] to a dry-cleaning process by drawing it separately through its bill" l71.

Naturally, all this cooing, twittering and touching (foreplay) in spring, should lead to the act of procreation. This paragraph was to have been filled with the "steamy sex life" of the American Crow. An intimate description of the intimate crow. Nothing doing. After eight years of peering through eight power, extra wide angle binoculars in **Guelph** and **Winnipeg**, I have noticed two crows on a lawn in March bobbing their heads together for about 20 seconds. That was it. My attempted crow voyeurism failed miserably. I have seen grackles, sparrows, pigeons, starlings, kestrels and merlins "doing it," all incidentally to hours of crow watching. The crow may be com-





While looking for nests of American Crows in March, I pause to enjoy the sleek, sensuous design of an empty milkweed follicle with its layered golden placenta that once held hundreds of imbricate seeds

mon and known to all, but its sex life is a well-kept secret. It is not splashed across the front page of your ornithological tabloid at the supermarket.

Finally, the magical moment came early in the morning on 29 March 1987. Some 15 minutes before sunrise, a pair of crows left their roost, (he about two minutes before she) and landed on a low horizontal branch. As soon as she alighted, two caws were made as mounting took place. The female spread her wings, lowered herself, and the male mounted her from the left side. Two sharp metallic notes were heard. With a typical flutter of wings, the mounting lasted about eight seconds. After dismounting, the birds perched 3 m apart and she began to preen. Then they both fed in an orchard for about five minutes prior to the start of nest-building.

Copulation

Lawrence Kilham was the first to describe the copulatory behavior of the American Crow in an avian journal. He observed 28 copulations (a North American record in the 1980s, which probably won't be broken for decades), of which 17 (60%) were on nests, 9 (32%) on the ground, and 2 on branches. Calls by the females were audible 250 m away in about half of the copulations. Incomplete mountings between adults and auxiliary birds in the cooperative unit were infrequent. Sometimes debris or a twig was held in the bill during the mounting. After a precopulatory pose

was struck on the ground, he “picked up a raccoon (*Procyon lotor*) vertebral column with pelvis and a femur attached and leaned it against his mate.” Later, a few days before incubation began, the crows appeared to be in a sexually playful mood. The male “picked up a wad of debris and walked to his mate. She immediately crouched in a precopulatory display. But the male, instead of mounting, lay on his side holding the debris toward her. Then he assumed a precopulatory pose and she attempted to mount him in a reverse mounting.” Sometimes the cu-koo note preceded copulation. Generally the act lasted 4–12 seconds and occurred during nest-building through the first few days of incubation. Reverse mounting (her on him) for the Northwestern Crow has also been noted. It lasted about 2 seconds, and occurred 3 days after their first nest failed j07.

Later, two yearlings did their best to mimic their parents. “When one picked up a lump of clay, it ran to its companion and lay down on its side. It stood up as the second yearling came behind and poked it on the back. At this the first one threw its head back as females do in copulating, while it still held the lump of clay” k49. Third crows can interfere with copulation. Kilham saw a yearling “pushing its lowered head under the two parents,” and “a confusion of four crows on a nest” k47.

A marked pair in **Los Angeles** stayed together for at least 9 years. Elsewhere, in Stillwater **Oklahoma** and Encino **California**, there





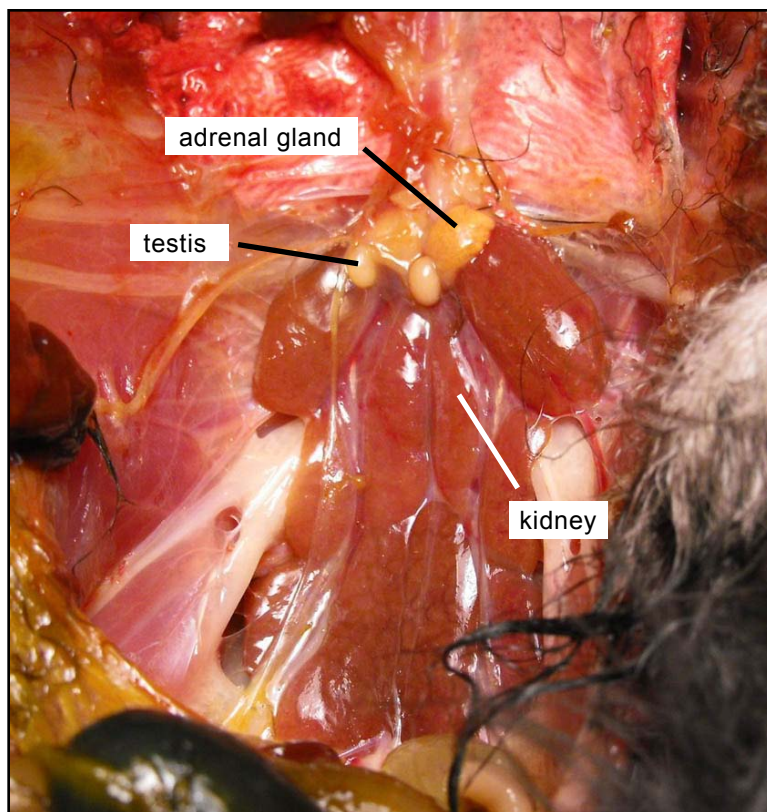
were over 100 mated pairs observed – with only one divorce. Their first nesting attempt was lost to a predator. Each found a new mate in an adjacent territory for the next season v18.

Sperm

In oscines (perching songbirds) electron-microscopy revealed an undulating membrane on each spermatozoon (sperm). Some cells may be bi- or multi-flagellated. The sperm of a few corvids has undergone scrutiny. A recent examination of sperm of the Blue Jay found the lack of a free flagellum h74. In the Hooded Crow, *Corvus corone*, the mature spermatozoon lacks a free flagellum (tail) r45. A free flagellum has been pictured for the Common (American) Crow m78. It was suggested an early researcher may have been describing a very late spermatid (with a flagellum) and not a mature spermatozoon (without a flagellum) in the American Crow. A free flagella does persist until quite late in spermiogenesis, but is eventually discarded r45.

Here are several thoughts on the refractory period of the testicular rhythm in birds. In young birds, the inactive tubule contents of the testes are free of fats. In adult birds, the Leydig cells between the tubules increase in size and their cholesterol-positive fats also increase. In the three photographs of the Rook on the **next two pages**, the Leydig cells appear black from the Sudan stain that dissolves in and colors the fats. As birds enter the breeding season, the Leydig cells increase in fat content as the sperm is being produced through meiosis in the tubules. The greatly expanded seminiferous tubules cause the Leydig cells to disperse. At the peak of sperm formation, the Leydig cells loose most of their fat content. Once the sperm has been shed, the tubules collapse as the dying debris left behind clears away. The size of the testes is reduced.

A new generation of Leydig cells forms be-



American Crow Paired tan testes, each c. 4 mm long in a juvenile male crow, are at the top of the lobed reddish kidneys. The yellowish paired adrenal glands are ahead of the kidneys. Crow died in Chatham, **Ontario** in early December 2011

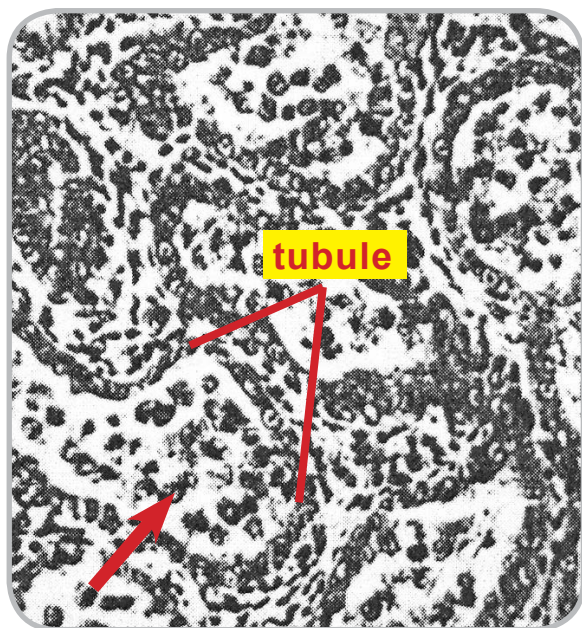
tween the tubules, and the cycle is ready to be repeated the next spring. Outwardly, the bird is molting after the breeding season has finished. External environmental stimuli cannot get the gonads to enter a new cycle. The testes must enter a period of regeneration and rehabilitation – a postnuptial metamorphosis m41.

American Crows have a diploid number of $2n = 80$ chromosomes and a fundamental number of 92 (total number of chromosome arms in a diploid nucleus) j58. Humans have $2n = 46$, wiki.

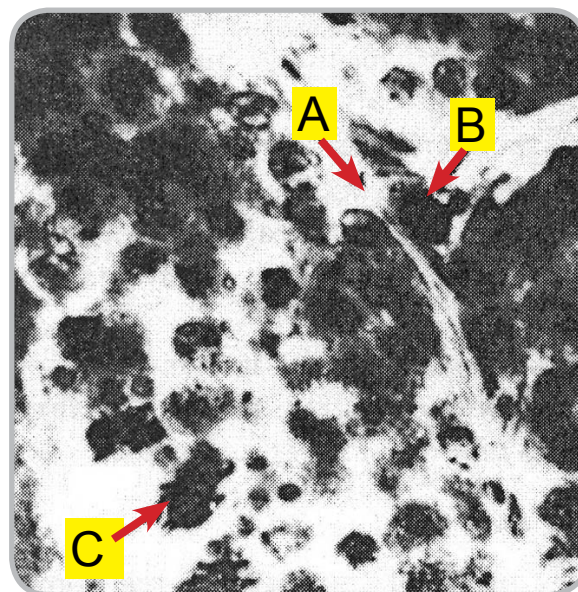
Extrapair copulations

There are recent descriptions of copulations by breeding pairs and attempts by other males in the family group to breed with the female. All 14 extrapair attempts at copulation were interfered with by the male breeder. In one instance, 4–6 birds landed together on the incubating female t63.





Rook – Section of adult testes collapsed during the period of reorganization after the breeding season and before the next cycle begins in the spring, x 530. Dead sperm debris occupies the tubules, (red arrow) m41, © the Wilson Ornithological Society



Rook – Section of adult testes approaching spermatogenesis x 800. The seminiferous tubules have increased in size. The smaller Leydig cells between them are pushed around. **A** is a Leydig cell without its lipids (fats). **B** is a Leydig cell that still retains its fats. **C** is a cluster of sperm cells formed by meiosis m41, © the Wilson Ornithological Society

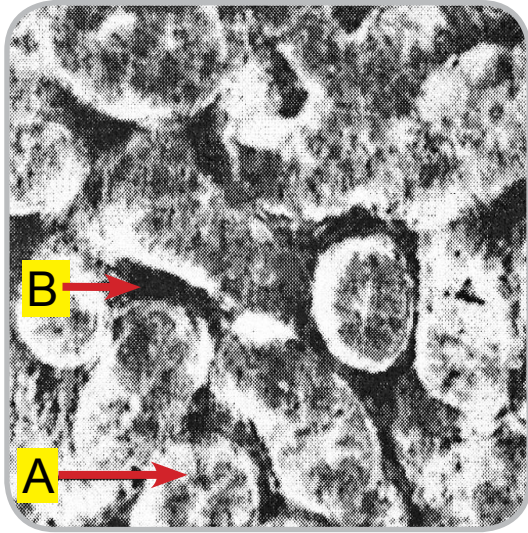
In Stillwater, **Oklahoma**, non-group males (3- and 4-year olds) visited the nest during incubation 9 times. These birds were from adjacent territories and were trying to copulate with the incubating female, usually without success. The female was aggressively non-receptive. Only once did the breeding male chase another male from the area of the nest. On one of 7 attempts, the incubating female mated on the nest with her breeding partner h06.

In Ithaca **New York**, extrapair copulations were reported in families of American Crows. In some cases, the pairing of related offspring (auxiliaries) with the breeding female did happen. The offspring exhibited differing levels of relatedness. In some years more than one extra male attempted to copulate with the breeding female, but generally she resisted their attempts t62. From 2004–'07, the work on genetic relatedness and reproductive partitioning continued on 21 family groups of breeding American Crows at Ithaca. The breeding females were the only females involved at nests. Males varied. Paired male breeders

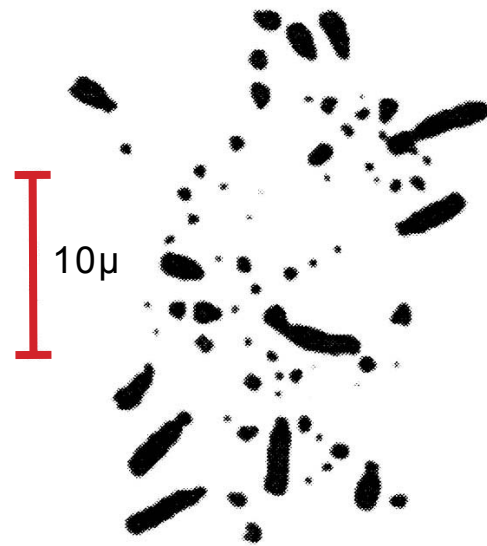
sired 83% of their offspring. Other (auxiliary) males within the cooperative group sired 7% of the young, and extragroup males helped sire 10% of the offspring. A chance for mating by the auxiliary males may have been the reason why helpers in this instance were biased toward males. Adult male breeders unrelated to the female and / or male breeders were sometimes in a family group. Auxiliary adult sons incestuously sired 4 (2%) offspring and stepsons sired 6 (3%) offspring. Most auxiliaries, 45 of 48 (94%) were relatives of the male breeders. There were more male auxiliaries and generally they were older than female auxiliaries in family groups. The dominant male breeders had partial control over the sexual behavior of the male auxiliaries and any outside males that tried to join their family group t63.

Genetic analysis of 321 offspring suggested 23% of mother-child pairings were first- or second-order kin. This led to higher rates of disease and an overall hazard rating for the most inbred crows compared to the least inbred birds. Inbreeding depression is part of the package of





Rook – Section of testes of an 11-month-old male Rook, x 400. **A** points to a quiescent spermatogenic tubule while **B** is a tract of Leydig interstitial cells increasing in fatty acid content. Leydig cells are responsible for the production of testosterone. They contain many fat-filled cavities m41, © the Wilson Ornithological Society



American Crow – Metaphase [second stage of cell division during which the chromosomes become attached to the spindle fibers] plate from cultured lung and kidney cells (Giemsa stain) j58, © American Ornithologists' Union

cooperatively breeding crows t61.

Genetic samples were gathered in 2004–'09 from 375 nestlings in 117 broods and 44 American Crow family groups at Ithaca **New York**. DNA was extracted from 150 µl blood samples. Each crow was sexed at diagnostic sex-linked alleles. To test the innate immunity responses, *Escherichia coli* was used in a microbiocidal assay of a crow's plasma. An index of each nestling's body condition was generated from measurements taken when they were 1–33 days old.

From birds that died, 21 with suitable background information succumbed to disease in 7 (1–13) months. These birds were in very poor condition as nestlings, (low body index) and were less heterozygous than birds dying from other causes. But the study did not directly answer the question of why some nestlings had a poor body condition. The links were missing and more experimentation over a longer time scale would help answer some of these questions about a wild population of American Crows.

Innate immune responses seemed to be independent of body condition of nestlings, but not

their size. Several factors in the breeding crows determined the body condition of each nestling along with inbreeding. In combination, the factors may lead to early disease and death, or to a long productive life as a crow t65.

Marked female crows in family groups were simultaneously tested for benefits to their young derived from extrapair paternity (breeding with a male outside their monogamous pair bond). Auxiliaries within a family average 4 (0–10) birds. Generally, auxiliaries were offspring from previous broods, but sometimes stepsons of the breeding female, nondescendant kin of the breeding male, or unrelated crows. Whether these sexual initiations were driven by the female or male was difficult to tell. In spite of this, it was suggested that neither sex was totally responsible for initiating extra-pair sex and paternity. The breeding of closely related individuals did lead to weaker nestlings from inbreeding depression. However, at the brood level, the auxiliary involved in the mating might invest more time in caring for all the young in the nest. From watches at 99 nests with helpers, the average rates of feeding over the 2007 and 2008 seasons ranged from 0.3 visits per





An American Crow preens itself each day. Often the white nictitating membrane is closed during this activity

hour for the female breeder to 6.6 visits per hour for all family group members combined. Auxiliary and overall feeding rates were higher at broods having the potential for within-group extrapair sires. The feeding rates by the breeding pair did not depend on the presence of potential within-group sires. The workload of the breeding pair remained the same t64.

Driving along the same road through a marked population of cooperative breeders of Carrion Crows in northern **Spain**, cohesive groups averaged 3.2 birds, but up to nine maintained territories year round. Unassisted (no helpers) breeding pairs occupied about 25% of the territories. The sex ratio in each group was biased toward males, with more than one female being rare. About 60 territories were sampled each year from 1998–2001. Blood was used to genetically determine relatedness. Shared reproduction was due mainly to a female breeder having more than one male breeder. Of 57 nestlings in 19 broods, 26% were sired in a polygamous way. Immigrants were therefore more likely to be males than females. Indeed, eight of 11 immigrants (73%) into social groups were male crows. The male of the mated pair might tolerate another male breeder since they appeared to help feed the nestlings more than nonbreeding helpers, and ensured nestling survival to fledging. Without immigrants,

the female bred only with her mate. Many Carrion Crows in **Spain** and other parts of Europe are not cooperative breeders b05.

The nest

The nest is the direct result of the bird's ingenuity, bounded only by its instinct and surroundings" 2b4. American Crows were classified as forest-edge nesters in a rural **Illinois** study j39. Then someone had a good look at the concept of edge species. It was concluded that "28 out of 30 recognized edge species were considered habitat specialists in terms of successional status. Based on these results, it was agreed that 'real

edge species' are probably quite rare". However, the generalist known as the American Crow was indeed a true edge species i07.

In **Maryland** and **Delaware**, riparian forested corridor widths, from less than 50 m out to about 800 m were surveyed in the early summer of 1988 and 1989 for avian abundance. Three categories



As the female crow incubates her 4 precious eggs, she may glance at the enlarging fruit of an American Elm where she spends her days





of birds responded differently in number of species to the width of the forest –

- (1) Neotropical migrant species increased with forest width
- (2) Short-distance migrant species decreased with increasing forest width
- (3) Resident species numbers were not related to the riparian width of the forest

The American Crow, a resident species, did show a slight decrease from 0.68 to 0.52 as the forest width increased. The Red-eyed Vireo, *Vireo olivaceus*, a neotropical migrant, increased from 0.6 to 1 as the width of the riparian forest increased to 800 m. To attract and maintain spring avian populations in forested corridors along a stream or river, the wider the forest the better. The minimum width should be 100 meters k21.

Nesting habitat and elevation

As a young man, I walked through hundreds of kms of farmland in southern **Ontario**. Crows nested in trees along narrow hedgerows between



A typical crow's nest near the top of a deciduous tree in a hedgerow in Essex County **Ontario** in the 1980s. Agriculture is the dominant theme in this southern county. Crows do very well in the summer and form a large winter roost



American Crows often nest in planted Colorado (Blue) Spruce in **Winnipeg**

crop fields. In comparison, parks, golf courses, cemeteries, small clumps of planted conifers and mature elms lining streets make ideal nesting habitat in numerous urban landscapes. Few crows inhabit open prairie and desert areas due to a lack of trees and suitable perching sites.

The American southwest is an area known for its paucity of crows. In **Arizona**, the top five nesting habitats were in montane forests and Great Basin conifer woodlands at elevations from 1,550–2,850 meters. Crows were most commonly found in the Flagstaff area, with some breeding north to the southern rim of the Grand Canyon 20c. In **California** 1,500 meters was the maximum nesting altitude above sea level s93. The elevation of nest trees, in **British Columbia** ranged from sea level to 1,800 meters c31.

In **Ontario**, crows were common summer residents, but scarce over the winter in the counties of Waterloo and Wellington 16s. In the flatlands of **Winnipeg**, crows nested in deciduous and coniferous trees at elevations of about 240 meters. Crows in Ontario built 240 nests in 11 types of habitat p25 –





This crow's nest near the top of a 90-year-old American Elm, dbh 80 cm, may last 3–5 years, but is usually used once: Winnipeg, **Manitoba**, January 2011

Coniferous 19%
 Deciduous 19%
 Farmland fencerows 13%
 Fields – overgrown or with isolated trees 11%
 Mixed stands 10%
 Urban – cemeteries, parks, residential, etc 10%
 Woodlands and reforested areas 6%
 Shoreline tree strips 5%
 Rocky islands 3%
 Orchards 2.5%
 Treed sand dunes 1%

Habitat of the 253 nests in Illinois –

45% in trees in open fields
 34% in woodlands
 14% in thinly wooded pasture lands
 7% in orchards, abandoned farm yards, cemeteries, thickets and tree plantations 955

Nest location, etc

From Knox County **Illinois**, Harold Holland noted a pair of crows nesting in the hollow of an old stub in a wooded tract for at least three seasons 975. On 8 June in **Wyoming**, a crow's nest on the ground held seven eggs. The general bulky structure of this nest resembled those constructed in trees 22w. At Fort Lapwai in **Idaho**, three active nests were in small birch trees with larger cottonwoods nearby b80.

Further west along the Santa Clara River in **California**, the smaller race of the American Crow, *Cb hesperis*, was a colonial nester with its nests 5–6 m above the ground in small cottonwoods and willows 975. In Encino **California**, on two golf courses, colonial nesting American Crows built nests in eucalyptus (*Eucalyptus* sp) and sycamore (*Platanus* sp) trees c13. The mean nest height was 19 m (n 88) c11. Most of the colonial nesting crows in a walnut orchard in **California** built their seasonal nests 5–7 m above the ground, and about 1/4 of the tree height from the top. The nests ranged from 2–9 m e40. Overall, the height of a nest location ranged from on the ground (rarely) to near the top of a 30 m tree. A pair of breeding crows redesigned the top of an old magpie nest for their own p84.

In **Saskatchewan** at Big Quill Lake, crows built their nests on the cross-arms of telephone





An American Crow, with a twig in its bill, returns to its nest in a pine tree in **Guelph**

poles in the treeless prairie, and atop chimneys in a church and an abandoned house ^{55b}. In another survey at Quill Lake in Saskatchewan, many nests of crows were 6–7 feet (about 2 m) above the ground in poplar thickets. On 23 June, a nest was on the ground among the dead branches of a fallen poplar tree. The nestlings had pin feathers ^{f21}. On a large island at the head of Lost Mountain Lake **Saskatchewan**, on 10 June 1913, several crows' nests were on the ground between rose bushes, while others were several centimeters above the ground in rose bushes and other shrubs. Most nests contained young crows. Within 4 m of these nests was a Mallard nest with 10 eggs, and a Short-eared Owl's, *Asio flammeus*, nest with 6 young ^{31m}.

On a waterfowl survey in **Manitoba**, a crew found four crows' nests situated on the ground and two over water among reeds. Two of these nests were in a treeless area, the other two were between trees holding many nests of crows ^{a10}. In the 1940s at the famous Delta Marsh in **Mani-**

toba, a nest was located in a small patch of tules (Bulrushes, *Schoenoplectus* spp.) 250 m from shore and about one kilometer from trees ^{06h}. In southern **Quebec**, right across the Vermont border, crows nested near the tops of fir trees ^{62m}. In 1928 at the Tantramar Marsh in **New Brunswick**, several nests were located in grass along the tops of dikes ^{32s}.

At Point Pelee **Ontario**, a handful of old nests of crows were located in bare trees over the winter ^{t10}. From a summary of Ontario's nest record cards at the Royal Ontario Museum in Toronto, the estimated heights of 292 crows' nests ranged from 0.6–26 m above ground, with 146 (50%) of these in the range of 5–11 m. No nest was found on the ground and 54% were in coniferous trees.



At Oak Hammock Marsh north of **Winnipeg**, American Crows have few trees available for nesting. Mammalian and other avian predators visit nests of waterfowl for a snack

In **British Columbia** one American Crow's nest was located on the ground while 61% of 251 nests were from 2.5–9 m above ground within an overall height range of 0–30 meters. Conifers held 41% of the nests ^{c31}. Also in British Columbia, Northwestern Crows placed 45% of their nests on the ground of Mandarte Island. Over 100 nests of the Northwestern Crow averaged a slim 2–3 m up in trees on the island ^{4b0}.

In **Winnipeg**, American Crows' nests in conifers were in the upper third of the tree and placed





near the main trunk with 2 or more branches below for support. In deciduous trees a large limb was often the main support for a nest.

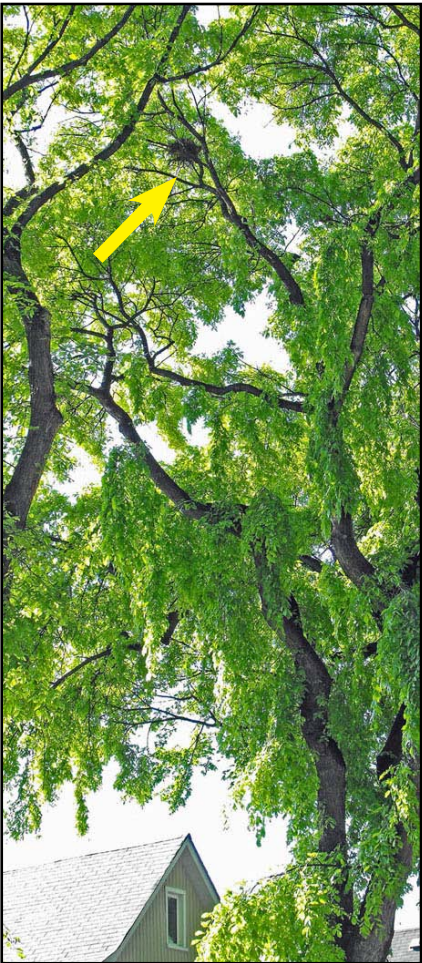
When crows choose to nest in trees, as they usually do, the total number of species used throughout North America is great, and varies according to locality and availability. From 151 of **Ontario's** nesting cards at the ROM, crows used 18 tree species, with about half of them deciduous. In a 100 nest sample from **Ohio**, crows also subscribed to 18 tree species, but none were coniferous. Unfortunately, it was not mentioned if coniferous trees were available for crows to use. Crows in Ohio displayed a favoritism towards nesting in oaks in relation to oak tree abundance g34.

63. In **Ontario**, two of the top 4 tree species used by American Crows for nesting were conifers, compared to none in **Ohio**

ONTARIO *	OHIO g34
Cedar 19%	Oak 45%
Pine 16%	Ash 13%
Maple 13%	Elm 11%
Beech 11%	Beech 10%
TOTAL 59%	TOTAL 79%
Willow 7	Osage, Hickory 2
Oak, Spruce 6	Catalpa, Maple 2
Hemlock 5	Cottonwood, Apple 2
Elm 4	Walnut 2
Hawthorn, Poplar 3	Hawthorn, Honey Locust 1
Apple, Ash 2%	Basswood, Crabapple 1
Basswood, Birch 1	Black Cherry 1
Aspen, Ironwood 1	Sycamore 1
Tamarack 1%	Kentucky Coffee 1%

* Ontario nest record cards (courtesy of the Royal Ontario Museum, Toronto)

A few types of trees used by nesting crows in **Kentucky** included beeches, oaks, and occasionally Red Cedars. The average height of 9 crow nests was 8.7 meters 16m. Crows nested in 27 species of trees in **Illinois**. Less than 3% of the 253 nests were in conifers, while the thorny



American Crows often build their nests near the tops of 100-year old American Elms in the Wolseley area of **Winnipeg**. I did not climb any trees to peer into their nests during my 2-year survey

Osage Orange, White Elm and White Oak combined held 50% of the nests. Oaks and elms were preferred over the numerous maples. Continuing in **Illinois**, 9 (3–18) meters was the average height of the 253 nests 20b. In the northern half of Illinois, 119 nests averaged 8.3 (2.4–15.2) meters above ground g55.

From 61 nests in **New York** state, 57% were in Beech and Oak combined, with only 5% in evergreens – Hemlock and Pine 1b3. My studies in **Guelph** and **Winnipeg** revealed urban crows made a choice to nest in conifers over the more numerous and suitable deciduous trees. Seclusion from humans and predators (squirrels, hawks, etc) were likely reasons from our view-





An American Elm near the main library in Winnipeg **Manitoba** held three recent nests (1 per year), probably built by the same pair of crows. The nest on the left was reused successfully 2 years after it was built. The pair nested nearby in another elm and a Colorado Spruce

point. In **Guelph** about 1 in 12 nests was in a deciduous tree in spite of many large maple, poplar and ash near a crow's chosen conifer. American Crows are flexible enough to make use of any available trees and nesting materials throughout their extensive range. A small survey in Guelph **Ontario** involved 11 crow nests in conifers. Six were in pine and five in spruce. Six of the nests were in a clump or row of conifers; five in more isolated trees. The 11 average trunk diameters at breast height (dbh) were 41 (21–74) cm; spruce averaged 34 and pine 47 cm. In **Winnipeg**, in 2008 and 2009, six tree species together held 47 active nests r28 –

- (1) **American Elm** *Ulmus americana* 37%
- (2) Colorado Spruce *Picea pungens* 29%
- (3) White Spruce *Picea glauca* 18%
- (4) Ash *Fraxinus* spp. 6%
- (5) Siberian Elm *Ulmus pumila* 6%
- (6) Scotch Pine *Pinus sylvestris* 4%

One American Elm near the main library held three recent nests, one per year (**photo above**). The nest on the left of the photograph was used successfully when built, then reused successfully two years later, presumably by the same unmarked pair of crows. For nesting, American Crows can switch from a deciduous tree one year

to a coniferous tree the next year and back again. From 97 nest-record cards at The Manitoba Museum, crows chose 14 tree species in **Manitoba**; 11 deciduous and two coniferous, plus an old abandoned house. Four of the nests were in dead trees, and poplars were a popular choice. Unexpectedly, in 2012 a medium-sized Basswood was used for nesting in Winnipeg, the first use for this fragrant species I have recorded (**photo below**).

Samuel L Bacon in Erie **Pennsylvania** wrote, “My observations lead me to believe that if unmolested, a pair of Crows will nest in the same vicinity for many years if not for a lifetime” 2b4. In the late 1890s, it was noticed that presumably the same pair of crows nested for the past 4 years in one 3 acre piece of woods, all four nests within 200 feet of each other. In the same woods are the remains of at least 10 other nests, probably built by the same pair of crows. Mr CW Crandall provided a few unusual locations of nests from the early 1890s 2b4.

- (1) in a large elm along a road, 15 m from a habitation
- (2) 30 m from a group of homes
- (3) one 9 m from a busy railway



This was the only American Crow's nest I found in a Basswood, *Tilia americana*, in **Winnipeg**. Basswood trees are planted in the city





American Crow A well supported nest in a Basswood tree will last a few years

(4) 30 m from the nest of a Red-shouldered Hawk.

In **Arizona**, American Crows nested in 20 different habitat / tree types – tall stands of cottonwoods, pinyon pine, juniper woodlands, ponderosa pine, and perhaps Russian Olive 20c. In **Florida**, two families of American Crows nested in Southern Live Oaks, *Quercus virginiana*, an evergreen k47.

In two different habitats in Cape Cod **Massachusetts**, the nesting biology of marked American Crows was studied from 1983–1987. One site was along a 7 km barrier beach; the other site was in a developed, broken habitat of Barnstable Massachusetts. All 48 nests were in conifers –

- (1) 88% were in Pitch Pine, *Pinus rigida*, the most common tree in the area
- (2) 4% in each of White Pine *Pinus strobus*, spruce *Picea* sp, and Eastern Red-cedar *Juniperus virginiana*

The mean nest tree height (n 44) was 11 (5.3–16.4) m and the mean nest height was 9.9 (4.6–15.4) meters. The nests averaged 10% below the top of a tree. Each year the crows built new nests (presumably in a new tree). One renest was also in a newly built nest c56.

In **Maine**, of 22 nests of crows, 12 were in

pinus, 6 in spruces, 3 in firs and 1 in an oak g75. TE McMullen recorded 179 crow nests in **Delaware, New Jersey and Pennsylvania** in g75 –

Oak 63%	Maple 7%
Pine 13%	Beech 6%
Cedar 10%	Hemlock 1%

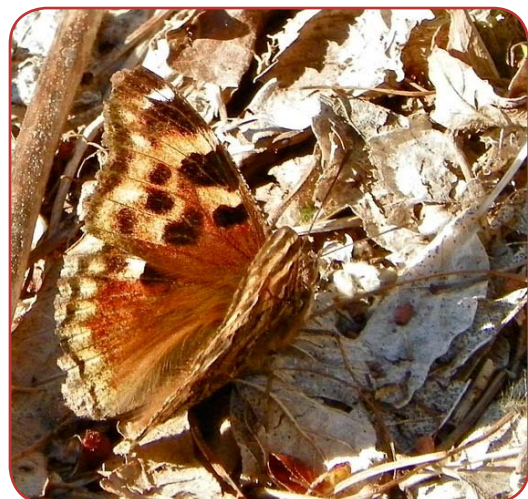
In Pennypack Park in Philadelphia **Pennsylvania**, 31 crow nests were in –

- (1) **Tulip Trees** 23%
- (2) Beech 16%
- (3) **Oaks**: white, red, black, pin 39% (combined)
- (4) Willow, Sassafras, White Ash, Wild cherry, Walnut 22% (combined)

The crows' nests in **Pennypack Park** ranged from 7.5 m (White Ash) to about 30 m (Tulip) above the ground r37.

In **Florida**, *Cb pascuus*, a smaller race of the American Crow, nested in a variety of tree species including Longleaf Pines, *Pinus palustris* g75. Their nests were lined with Spanish Moss, horsehair, and Cabbage Palm fibers 42h. Other trees used by crows in **Florida** included – mangrove, gumbo limbo, cabbage palm, pine, oak and hardwoods in the northern part of the state b09.

Fish and American Crows nested at the western tip of Long Island **New York**. Fish Crows nested closer to water and on salt marsh is-



Compton Tortoise Shell – **Winnipeg**





lands with 94% of their 19 nests in deciduous trees, mainly because few conifers existed. They chose to nest in native trees (82%) over exotic species even though the two types were almost equally represented – 48% native, 52% exotic. In contrast, 23 American Crow nests nearer human habitations were built in coniferous (65%) and deciduous (35%) trees where conifers accounted for only 30% of the available trees. Exotic trees were used (74%) with their availability at (57%). Crows nested in Japanese Black Pine, *Pinus thunbergii*. Both species of crows chose trees that were generally larger / taller than trees in the general



A pair of breeding crows on their new nest in an American Elm in **Winnipeg**

population and both placed their nests near the tops of trees.

Fish Crows / **American Crows** on Long Island generated the following numbers respectively for their nest-trees –

mean distance to another crow's nest 139 / **625 m**
 mean distance to water 166 / **361 m**
 mean distance to waterbird colony 10 / **3,242 m**
 mean distance to a building 1,479 / **186 m**
 mean distance to lawn 1,524 / **75 m**
 mean distance to the nearest tree 14 / **2 m**
 mean nest tree dbh 82 / **65 cm**
 mean nest tree height 9 / **12 m**
 mean nest height 7 / **10 meters**

Fish Crows were closely associated with the natural habitat of coastal environments where colonies of waterbirds nested, which generated some of their food. American Crows often nested in habitats altered by humans including recreational areas in a National Park, and in residential and commercial areas with an abundance of human garbage and mowed grassy areas¹²⁵. Although both species preyed on eggs and chicks of other birds, including those of Piping Plovers, the Fish Crow was a specialist in this area, and located their nests close to their food source⁹²¹.

In the **Great Basin** in the southwestern part of the United States, American Crows nested mainly in willows along rivers. Nearby, open meadows furnished feeding areas. In **Nevada**, crows used “oases” of about 3 acres (1.2 ha) with small springs. Nests were in dense groups of Buffalo Berry *Shepherdia argentea* and Hawthorn *Crataegus* species. Trees occasionally used included Narrowleaf Cottonwood *Populus angustifolia*, Black Locust *Robinia pseudoacacia*, and Quaking Aspen *Populus tremuloides*¹⁵³.

My Winnipeg study (2008 & 2009)

In Winnipeg **Manitoba**, data on 47 trees used for nesting by American Crows –

- (1) the average dbh 44 (17–95) cm
- (2) deciduous nest-trees (47%) had diameters of 60 (19–95) cm
- (3) coniferous nest-trees (53%) had diameters of 28 (17–40) cm
- (4) the nearest tree was an average of 7 (2–24) m away with an average dbh of 38 (14–80) cm
- (5) the nearest tree was deciduous 61% of the time and coniferous 39% of the time
- (6) the second nearest tree was an average of 10





A dead branch in a deciduous tree is a good place to perch for a wing and leg stretch

(2–31) m away with an average dbh of 40 (15–83) cm

(7) the second nearest tree was deciduous 65% and coniferous 35% of the time

(8) an average of 20 (0–90) m from the nearest building

(9) an average of 15 (1–68) m from the nearest road (not a driveway or alley)

Crows chose to nest in conifers as often as in deciduous trees even though the ratio of deciduous trees to conifers was 12 to 2 and 2 to 1 from my brief bus and walking surveys in **Winnipeg**, Manitoba ^{r28}.

When the nest-tree was deciduous, the nearest tree was deciduous 84% of the time and the second nearest tree 92% of the time. Crows nesting in deciduous trees were usually among deciduous trees; such as a treed boulevard with mature American Elms evenly spaced. When the nest-tree was coniferous, the nearest and second nearest trees were coniferous 72% and 52% respectively. Coniferous nest-trees were isolated or in clusters. Planted clusters of about 20 older Colorado Spruce were very attractive to breeding pairs ^{r28}.

One unusual nest was in a spruce tree (dbh 22 cm) at the edge of a sculptural garden on the 4-storey, concrete roof of the Winnipeg Art Gallery ([page 68](#)). A similar spruce tree was a few meters

away and old nests in each indicated the pair had probably nested in both trees for at least a few years. The trees were cut down in 2009 during a renovation. This is the first report of crows nesting in a tree growing on the roof of a building. Within two years after my urban study ended, two other conifers, which held successful nests, were also removed in the city.

For American Crows in and around Ithaca **New York**, nest-tree differences were proportional and not great –

SUBURBAN CROWS

Average tree height 21 m (n 327)

Average nest height 19 m (5–34) (n 329)

Nest height below nest tree top 12%

Nests in coniferous trees 96% (n 386)

RURAL CROWS

Average tree height 18 m (n 85)

Averaged nest height 15 m (4.5–24) (n 85)

Nest height below nest tree top 17%

Nests in coniferous trees 83% (n 100)

Nests (429) in coniferous trees averaged 12% from the top of the trees, and 38 nests in deciduous trees were 30% from the top of the trees. Analysis showed no interaction between habitat and tree type ^{m85}.

On 160 ha in central **Spain**, the Azure-winged Magpie, *Cyanopica cyanus*, chose two main nest-tree types – Holm Oak, *Quercus rotundifo*





Two crows feeding in a park at mid-day

lia, an evergreen tree, and Ash, *Fraxinus excelsior*, a deciduous tree, which together held 78% of their nests. Nests in oak held their first egg (average 22 April) 7 days earlier than nests in the deciduous ash trees (average 29 April). The nest sites were a non-random subset of those available to the magpies. Magpies chose the nest site location to maximize the concealment of their nests [our standard response] a20.

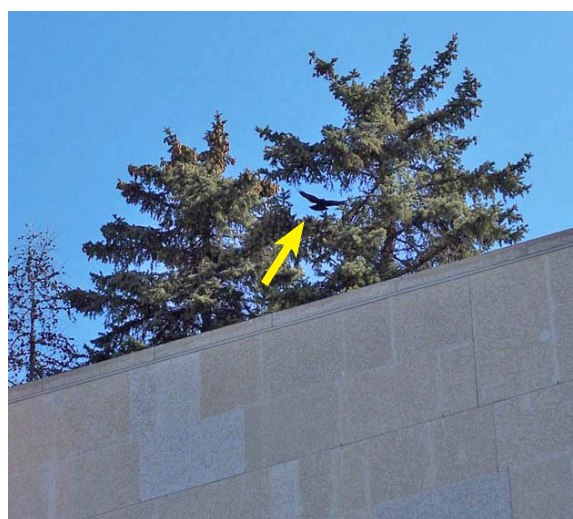
In southern **Ontario** in March and April, nests (old and new) in bare deciduous trees were visible to about 200 m away from the roads. In the other direction, urban crow nests in conifers are more difficult to locate. Watching a crow carrying nesting material in its bill and landing near the top of a tree, or bringing food to nestlings in May, were sure signs of an active nest. However, it was always a cheerful moment when, through form alone, I located an active crow's nest, especially in a conifer, without help from the owner.

Nesting territory

Three crows flew in low from the north and landed in a row of tall conifers. They were only 50 m from an occupied nest. Within seconds the visitors were met by a loud, vocal attack from the breeding male that landed between them and his nest. Quickly he and his rival, probably another male, collided in the air and fell together through the coniferous branches. Feathers flew and the calling continued. Leaving her nest and eggs, the female flew to assist her mate. More calling and aerial rushes forced the trespassers to withdraw. An intense territorial struggle of five minutes had passed. The intensity (2 locked crows falling through the air) may have been due to the closeness of the intruders to the active nest.

Overall, the Breeding Bird Surveys (BBS) from 1985–1991 showed the eastern half of the United States held more breeding crows per survey than the western half of the country. Grasslands also supported few breeding pairs (probably due to a lack of trees). The **Canadian Prairies**, especially Alberta and Saskatchewan held substantial spring / summer populations in the parklands 02p.

I should add the breeding population of crows



American Crow (arrow) arriving at nest in the spruce on right. The pair nested successfully atop the 4-story roof of the Winnipeg Art Gallery in **Manitoba**, until renovators removed the trees





in the City of **Winnipeg** was valuable. I easily located 47 nests during my 2-year survey, which I conducted alone, on foot and by bus. On each of two days, three active nests were found in about 6 hours of searching. Nests in the city were much easier to locate the second year since many pairs nested on the same territory as in the previous year; two pairs nested in their previous nests.

Some of the unmarked mated crows in Guelph **Ontario** remained on and defended their territories year round. Without an established



Immobile for 3 minutes near its nest in May



Raccoon One of many predators of the American Crow during the nesting season. Portrait from Wikipedia. Photographer unknown. Original in MacClintock, Dorcas (1981). *A Natural History of Raccoons*. Caldwell, New Jersey, © The Blackburn Press, with notification

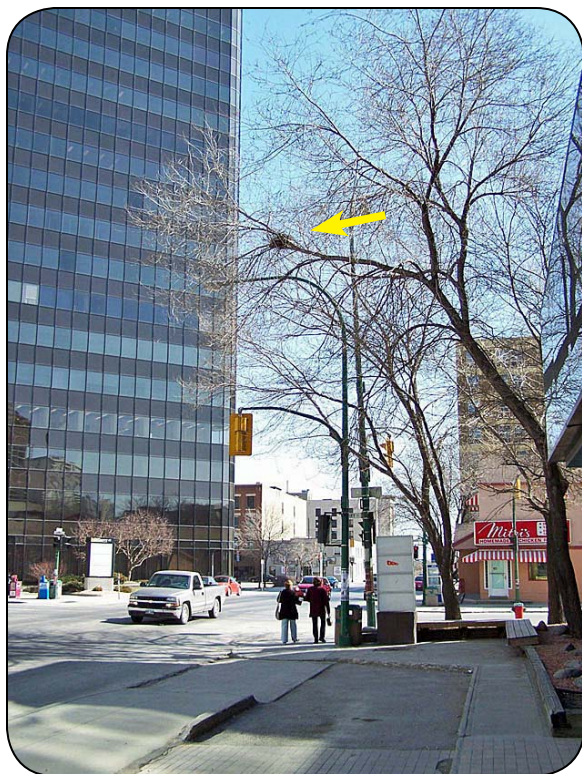
territory, nesting cannot take place. Many pairs of unmarked crows have probably maintained the same territory throughout several years in the city. Their movements, perching sites and behavior were familiar to me, and my behavior was familiar to them. Over the year, families roost on their territory in different trees. Carolee Caffrey noticed that some of the breeding males joined small local roosts ^{v18}. Depending on location, crows in the fall may migrate from their breeding territory and travel hundreds of kilometers to familiar winter roosts made up of thousands of families and individuals. Others travel a few kms each day to a local roost, then return to their breeding territory to feed over the winter. ^{c06}.

Explanations, theories, and examples of territories abound. The concept of territory is still undergoing refinement as biologists try to fit their theories to their observations, and what they see into a theory. One idea – territories provide social contact between pairs and families of birds with their own kind. The defense of a territory provides the stimulation required to enhance the reproductive process or condition and is not due to any “vital requisites” in it ^{d09}.

In a review paper, 18 ravens, crows and jays had their body size, territory size, and breeding strategy investigated. The American Crow was not part of this study. The Corvidae revealed no obvious relationship between size of body and size of territory. For a breeding strategy involving singular nesters (one successful nest per territory per year, as is the way of American Crows), an energy-rich territory (one with plenty of food) should attract and hold a small family ^{s58}.

In **Delaware**, an interesting comparison was made on the general pattern of birds of various sizes (body mass) occupying different sizes of forested landscape. Generally, a community of birds in the forest may be predicted by their home range needs and the weight of a bird for a species where weight indicated competitiveness. A study of 296 patches revealed that very small (warblers) and very large birds (American Crows) showed an increase in abundance (from survey counts) as the local forest, patch area, and cover increased, and the patch isolation decreased. “Body mass may be sufficient to predict, within bounds, avian community composition and the abundance of





American Crow A successful nest in a Siberian Elm in downtown **Winnipeg**

each species within a forest patch” 0b1.

In establishing a territory, birds rely on the presence of conspecifics to indicate the suitability of the area they wish to colonize 022. A comment was made on the viability of super territories 2b0, but so far nothing “super” has been noted about territories of American Crows. It was suggested the behavior of subordinate individuals was necessary in keeping the territorial peace k20.

Neither Good nor Black, from many hours of observing American Crows in the countryside of **Ohio** and **Illinois**, mentioned territorial disputes. From this they concluded only the immediate area near the nest was defended g34, 20b. Since I noted territorial disputes between urban crows almost daily and throughout the year, and well away from their nests, I began to imagine the stressful existence in a city resulted in more disputes. This notion was put to rest when Kilham published a note on the displays and chases between two families of crows over farmland of **New Hampshire**. He described “aerial melees with all members of both groups swirling into the air for

3–4 seconds” a manoeuvre repeated five times in 12 minutes as opposing crows flew at each other from treetop perches. Other encounters took place on the ground. Kilham also pictured slow, circular flights by one group of crows passing slightly over the neighbor’s border k52. In a short note, he described 45 encounters between two groups of crows in New Hampshire that included cawing from tree tops, walking displays, clashes, close encounters, aerial melees and displacement activities k57. In **Florida** Kilham and his wife saw 19 territorial disputes over two years in both January and February (the start of the breeding season) between two families of rural American Crows. In one instance a crow whacked another in flight k47.

Most of what Kilham k53 described, I observed for crows in the city. He did not, however, mention the violent locking and falling through the air by two crows which I described earlier. These close encounters were rare but they held your attention. A limping bird was the only injury I noticed after such an entanglement. My pharmacist Barbara mentioned two crows locked in combat on a street. Calling and chasing generally serve as a pathway to a settlement. American Crows in the Cape Cod area of **Massachusetts** defended their year-round territories. The breeders were the initiators (aggressors) and the helpers joined in the fun. Over the winter, crows left their territories at dusk to form a communal roost, then returned to their territories at dawn c56.

On two golf courses in Encino **California**,



Cottonwood, fledgling, windy morning





American Crow Unmarked successful adult breeder in a Cottonwood on 2 June 2011, near one of its 3 fledglings in **Winnipeg**

Caffrey reported the distances between nests averaged 64 meters. In this crowded situation, the breeding crows “rarely prevented others [crows] from entering their nest tree or landing on or near their nest.” Breeders rarely defended their core territories and often fed together nearby. First time breeders, over 5 years, set themselves up in the interior of the colony, and three pairs chose the periphery for their first try at nesting. When one male breeder died, his mate continued feeding their 4 nestlings and she managed to raise one fledgling. Territories left vacant by death were not readily filled by new birds or taken over by adjacent breeders. One territory was vacant four years later. At other times, a few breeders left their territories in the spring, but returned to them early in the summer. Their vacant territories were not filled by the time they returned. When new territories were established, seven new pairs settled (squeezed) into occupied territories within a distance of two core areas of their natal one.

The nonbreeding flock near the

nesters occupied about 4 ha, but was not restricted to that area. At least 7 crows of both sexes attempted breeding after only one year with the flock, leading to speculation the flock may serve as a way to meet breeding mates. One breeding male, at least 7 years old, lost his mate and joined the nonbreeding flock.

Assuming juveniles become self-sustaining about 2 months after fledging, 18% left their natal area in their first autumn to join the nonbreeding flock, or for parts unknown. One half (9%) of these crows returned home as yearlings the next breeding season. In February of their first winter, 12% of those remaining with the natal family group left home (dispersed). In all, about 55% of juveniles remained with the family over their first year and some stayed longer. Caffrey could find no relationship between dispersal and the various nesting factors, possibly due to small sample sizes. The first breeding attempts of 6 females and 8 males were not successful. She found it difficult to believe that lack of daily resources in her breeding population of crows, or lack of mate acquisition or territory in which to nest were the reasons for delayed breeding past 2 years since all these attributes were available to her crows. Perhaps more females stayed with their parents to learn the culture of nest building, how to feed nestlings, and other aspects of the breeding theatre c09.

When an American Crow intended to defend its territory, it flew in a very straight line toward



When a Red Squirrel enters the nest-tree of a crow, it is routed





Breeding pair on their urban territory in early spring

another crow or group of crows that posed a threat. Its wing beat reminded me of a Mourning Dove's, *Zenaida macroura*, wing beat. This particular wing beat propelled the crow quickly to its destination (up to 500 m away) and I have only seen it used during territorial encounters. It probably signifies to the intruding crow that something exciting is about to happen.

I have yet to record home crows losing to the visitors, and never do visiting crows get much closer than about 50 m to home plate (the nest). Home crows have the advantage and are always alert. They respond quickly to the calls and movements of neighboring birds when they indicate trouble. More than once, while timing the summer roosting behavior of a family of crows in Guelph, I watched them enter a conifer to settle in for the night, only to have one or two birds jump from the branches and chase a crow flying as much as 100 m away over a part of their territory. Even as darkness was winning, crows maintained a remarkable awareness of their surroundings. Some crows, for whatever reason, can violate the air space above or near a nest with impunity. Black has also

observed this dichotomy 20b. It may be the “intruders” are recognized as members of a related family, or their intentions, however conveyed, do not involve a hostile takeover.

In four breeding families of American Crows in **Florida**, the adult males dominated. These males “called more, did most of the wing-and tail-flicking, held their head more erect, looked bigger (because they held their wings slightly away from the body) than any other bird in the group, and took the lead in territorial encounters” k63.

In Encino **California**, Carolee Caffrey saw little male aggression, possibly due to the more colonial nesting habit of her crows on a golf course. She had family groups of up to 12 individuals, including adult auxiliaries, which did not directly help in the nesting process v18.

Northwestern Crows, in a colonial nesting situation, defended their small territories. Unrelated yearlings and adult crows were repelled 80% of the time by the breeding male and 20% by the breeding female 4b0. Some juvenile Ameri-



American Crow Sentinel (a parent) atop a Cottonwood near its nest in May in **Winnipeg**





American Crow Below its nest in an American Elm, the unused and broken twigs fall during nest-building and add abstract ideas to the sidewalk

can Crows showed little concern about territorial disputes over their first summer. When a dispute developed one August morning in **Guelph**, the parents left the two juveniles and flew 100 m to engage in a vocal encounter with a neighboring family. The young crows continued to play and feed without glancing in their parents' direction.

Along with high visibility, a crow's voice helps to define who and where it is. To my ears there appears to be little difference in the calls of the female and male. Between themselves, there probably is an obvious difference. Once I was familiar with the location of several active nests in **Guelph**, I often positioned myself near them early in the morning to listen for the initial calls of the day. These first calls changed each morning. There did not appear to be a specific call for each crow or pair of crows that I could recognize. I suspect crows were awake many minutes before they actually began their dawn chorus. Generally, the pair of crows roosted overnight within 100 m of their nest-site. If the nest was in a row of coniferous trees, the birds might roost several meters away in the row. The nest tree was not used as the roost, even when it was isolated. An unusual pair of crows in the early phase of nest-building, roosted more than one kilometer from their nest. I was never able to



American Crow getting another twig for its nest

backtrack to their roosting site based on the direction of their incoming morning flight to their nest.

A pair of crows moving around on their territory may pass through the territories of other species of nesting birds. Leech Lake is one of the largest water bodies in **Minnesota**. It decorates the north central landscape near the source of the Mississippi River. Crows were common. One nesting pair occupied a lone scrub oak in a marsh. Every time a crow left to get food for its nestlings, the mobbing by Red-winged Blackbirds and Kingbirds made its flight difficult 56c.



A Tree Swallow at Oak Hammock Marsh in mid-June





Living with crows

With my hiking boots on and clipboard holding a campus map in hand, I set out on a wonderful adventure. As many ethologists before me discovered, only by following a group of animals and “living” with them do you achieve a level of awareness of their lives not possible from smaller samples of daily behavior stitched together. In partial fulfilment of this idea, for seven days in seven months, I walked and trailed one family of crows from dawn to dusk on the campus of the University of Guelph in southern **Ontario**. My aim was to gain an appreciation of their vocal output, size of territory, and behavior. My seven days of passion were successful and are summarized in **Table 75**. A brief look at the highlights of the seven days is revealing. The fewest bouts of caws (61) on 21 April 1985 coincided with incubation, a time of secrecy and little activity. That number of bouts of calling was only 14% of the 450 recorded bouts a month earlier. The unmarked male crow did, I believe, nearly all of the singing as she

warmed the eggs. On 13 July 1985, I recorded about 280 single begging caws by the two juvenile crows in addition to 420 bouts of caws from the parents. **Table 75** does not indicate the early part of the morning was filled with song. The first 120 (97–133) minutes of the day carried 46% (24–62) of the total recorded calls for the day. The territorial size varied seasonally and most days, averaging 15 (8–20) hectares.

Each of my seven crow-days brought revelations about the way these august birds conduct themselves. On 5 August 1984, beginning at noon, the parents and five juveniles had a half-hour nap in conifers about 80 m from the old nest site. Earlier in the morning, the juveniles playfully hung upside down. For six of the seven days, the parents remained on their territory, but on 9 December 1984, with all their young departed, at 11:50 the adults flew north out of sight, only to return from the same direction 50 minutes later. Perhaps they visited the territory of a breeding daughter or went sightseeing. Under a clear cold, 3 February 1985 sky, the only nourishment taken by the pair of breeding crows was junk food dropped along a sidewalk in the snow. A crow hid one piece of this food and their feeding (one bout) for the day ended in the late morning. One crow (the male?) fought briefly with its hard, unyielding reflection at a third-story window. Generally, the 2 crows spent the afternoon perched in trees and warming them-



Breeding American Crow gathering old leaves as nest lining from a dirty snow bank on 27 March 2011





75. American Crow The fewest bouts of caws (**61**) occurred on 21 April 1985 during incubation when secrecy was necessary. The smallest territorial size (**8** hectares) was on 3 February with 30 cm of snow cover, for a resident family on the University campus during 7 days in Guelph **Ontario**

Sunrise to Sunset (minutes)	Dates 1984–'85	FAMILY SKETCH	Number of bouts*	size of territory (hectares)
864	5 August	2 adults, 5 juveniles 8 weeks old	----	13
541	9 December	2 adults, patchy snow, +5 °C	497	19
600	3 February	2 adults, 30 cm snow, –15 °C	316	8
737	23 March	2 adults, nest building	450	20
824	21 April	2 adults, incubating	61	13
903	25 May	2 adults, nestling about 20 days old	170	10
909	13 July	2 adults, 2 juveniles 5 weeks old	420	20
AVERAGE			320	15

* About 5% of this figure might be added to adjust for my short absences each day.

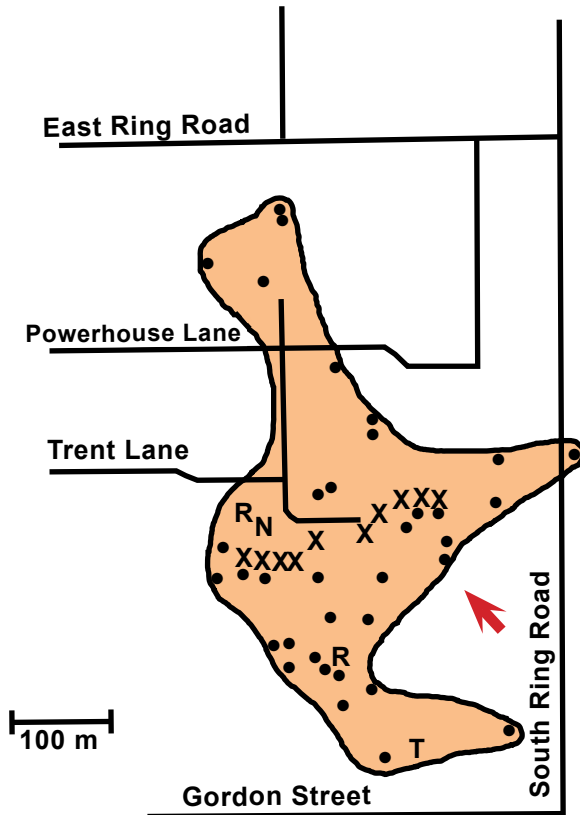
selves in the sun. Their territory was the smallest at 8 hectares on 3 February (**Map 76a**).

By 23 March 1985, nest-building was under-way. Now the pair remained physically close and very active, stopping for short slices of time at many locations. Naps were not an indulgence. On 21 April 1985, he roosted about 80 m from the nest. As she incubated the eggs during the day, he perched at the corner of a campus building higher than the nest-tree and guarded the area. Then he had a longer fight with his window reflection, and later she joined him during a territorial dispute. On 25 May 1985, starting at 12:30, she? perched on the rim of the nest and sheltered her 20-day old nestlings from the bright sun with her wings and body for about 90 minutes, or so her body language indicated. A hot 13 July 1985 caused the entire family of 4, to rest without calling for almost two hours within a large maple tree beginning about noon. More of the territorial activity on this day is depicted on (**Map 76**).

As soon as the first calls in the faint morning light were given, the American Crows shifted to the top of their roosting tree or, if it was a cold

wintery day, to a nearby tree or rooftop where they waited for several minutes before beginning their day's adventure. The family of crows on the campus began their first meal on their territory 16 (35–0) minutes before sunrise based on 26 mornings, regardless of weather or season. Often the first meal lasted 10–15 minutes and was over before sunrise. Most days, throughout the spring and summer, they flew about 300 m from their roost to feed on a large open lawn next to a large parking lot. The last meal of the day, based on observations of several families of crows in the city was almost always over 30 minutes before sunset. In **Illinois** "feeding grounds were shared at all times with birds from neighboring nests." It seemed rural crows had no well defined or defended territory, except for the nest tree 20b. Marked crows nesting in Urbana **Illinois** shared communal feeding grounds in agricultural fields outside the city and roosted overnight in the city Y¹¹. Only once have I witnesses two large families of crows in Guelph mingling and feeding together over the summer. This was on the lawn of a baseball diamond, mostly in shallow left field.

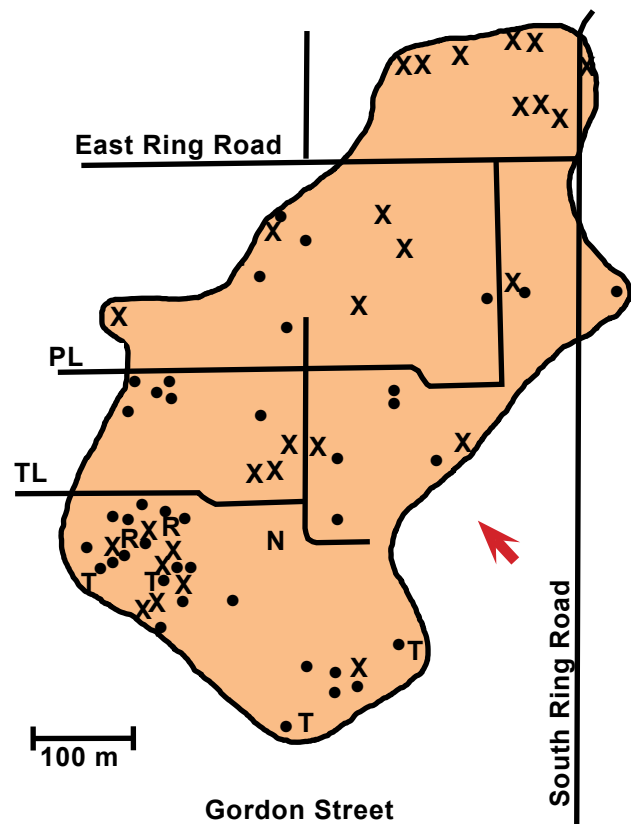




76a. 3 February 1985 The day's activities of a mated pair of American Crows on 8 hectares. Their activities were concentrated in the central part of their territory, near the nest and roosts. They had one territorial dispute, 10 areas of feeding and roosted in two different locations on the University of Guelph campus. Sunny, -15°C , 30 cm of snow cover

N – Nest
R – Roost
T – Territorial dispute
X – Feeding
• – Perching

76. 13 July 1985 The day's activities of a mated pair of American Crows on 20 hectares. They had 4 territorial disputes in two regions of their territory, fed throughout much of their territory, and roosted in two separate but close locations, which were different from the two on the 3 February map above. The University of Guelph campus. Sunny, $+30^{\circ}\text{C}$





A crow's nest in a deciduous tree in **Ohio** 934, © E Good

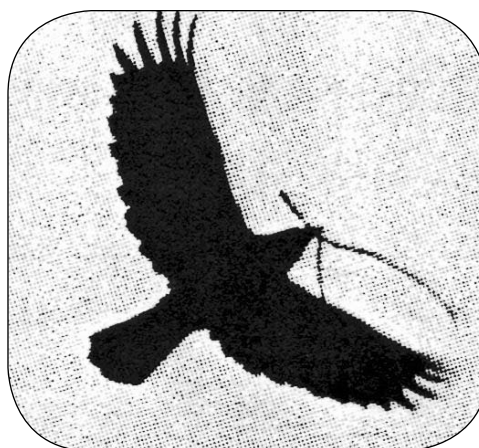
After the final meal of the day in Guelph, the family of crows perched in several places for some time before retiring to their roost. This made it difficult to decide when roosting actually began for the night. It was getting dark, and the pair of crows were still shifting about to different conifers, branches, and elevations. At what time they tucked their bills into the back feathers was not known. Throughout the city, I believe conifers were the only trees used for roosting in cold weather. With the arrival of summer, both coniferous and deciduous trees were used. The university family used at least five roosting sites near the nest-tree over the course of a year. When the parents and young roosted in a deciduous tree, there was a meter or two between the birds and some differences in height. At times the juveniles roosted separately from their parents, and occasionally the adults, when alone, also roosted in separate trees. The top canopy branches were kept for daytime lookouts, while lower in the trees, hidden and protected from our ideas, the birds peacefully spent an urban night.

In **Winnipeg**, deciduous Manitoba Maple trees (about 20 cm dbh) within 50 m of a successful nest in a Colorado Spruce, were used for roosting in the summer and into October by the family. In the fall, with compound leaves remaining on the maples, the crows roosted quite high in the tree on 2 cm wide horizontal branches with a good blanket of leaves between them and the star-filled sky. The birds were about 1 m apart

when three of them roosted in the same tree and sometimes one crow roosted alone in an adjacent maple. In the spring, as a nest previously used two years earlier by the pair was being renovated in a American Elm, the pair of crows chose to roost in nearby deciduous trees, the same small group of maples they used the previous fall. Now, without leaves to hide them from above, they slept on lower 10–15 cm wide limbs, which broke their silhouette from above, and provided a firm launch pad should an owl visit.

We have split the atom and the second to help us keep track of things. On a somewhat larger scale, the daily time budget study was developed to chart our every move. Similar studies were tried on wild birds. In easy terms, a crow on its territory spends its night roosting, and its day flying, feeding, and perching. How much time do each of these activities take? No information exists for the American Crow. The Black-billed Magpie in Pullman **Washington**, near the Idaho border, gave some answers. On 646 ha of the University of Washington state campus, the magpie population had 18 nests completed by mid-April. Their activities 66m –

Flying 7%
Feeding 38%
Roosting 45%
Perching 55%



Towards the nest in April





Before ending this section, we should consider the population structure. In most territorial populations there is a growing interest in, and understanding of floaters. These are variously aged birds with restricted but organized home ranges between or on the edge of established territories^{02s}. It was once believed floaters quickly took over an established territory when it became vacant. In central **Ohio**, Good recorded a flock of 35–75 unmated crows on about 1,000 ha over much of the breeding season⁹³⁴. For the Carrion / Hooded Crow, Coombs divided the population into territory-holding pairs and flocks of immature birds (juveniles and yearlings) and sexually mature individuals. When a female crow was alone after her mate died, she would be displaced. The male on his own might last longer, or give way to an underworld floater^{19c}. Earlier, Caffrey mentioned that territorial vacancies in the crowded breeding colonies on golf courses in **California** were not filled immediately, some not for years^{c09}.

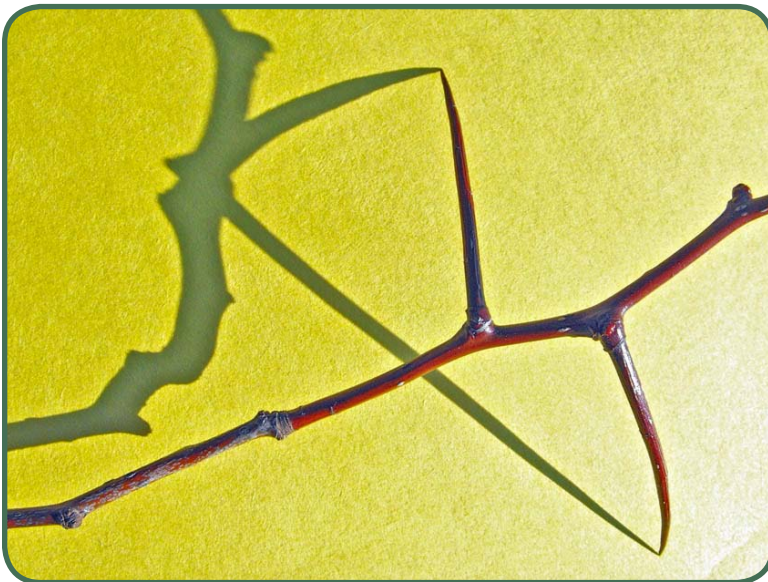
This replacement phenomenon is important in maintaining the breeding population of crows. From our viewpoint, management aimed to reduce or eliminate a local, but large breeding population by the trap-and-release method is probably doomed. If this study in the Netherlands was at all indicative, the opposite resulted. During one



Crow watching pedestrians in **Winnipeg**

year 337 Carrion Crows and 223 Jackdaws in the 1980s were live-trapped for removal. Throughout most of the year's work the population level of the two species was stable and at the end of the year there were almost twice as many corvids as before. It appeared the influx of low-ranking birds filled the voids. Since they were not as capable as the original territorial holders in defending against their own species, more birds infiltrated the available habitat than before^{24s}.

Along the western side of the Olympic Peninsula of **Washington** state, American Crows, Common Ravens, and Steller's Jays have adjusted to human settlements. Crows nesting more than 5 km from a settlement or campground had ranges about five times larger than crows nesting less than 1 km from the above. Close to human settlements, breeding crows allowed their territories to overlap considerably and only the nest area was defended. Overall, their reproductive effort increased, resulting in more crows, and the adults lived longer. Our household garbage attracts crows to our settle-



American Crows occasionally nest in hawthorn trees in Ontario, Utah and elsewhere





When crows nest on the ground, they build a huge nest to ward off mammalian predators. This typical nest was 5 meters wide and beginning to take shape. Red Osier was the main material in the outer rim. Nest found in the English Garden in Winnipeg, early April 2012

ments. Even though crows increased in numbers at settlements, small mammals and jays were the main predators on nests of birds in the same neighborhood. To reduce crows around settlements, our behavior has to change to curtail the availability of food we discard as we colonize the planet, one village, or one campground at a time

m54. But then, it is pleasant for some of us to hear a crow calling in the morning when we awake in a campground. It may remind us of crows calling in the city where we spend most of our lives. Yet, if we wish to continue to expand and build in pristine areas, we should closely manage our waste, thereby removing “crow foraging opportunities” so crows do not follow us n07. If we don’t want crows in the remote forests, perhaps we should remove ourselves from these lands as well. Crows follow us wherever we go because experience has taught them we like to dump our garbage everywhere. It is how we mark our territories.

Summarizing several studies of American Crows in different locations in the United States, breeding pairs had territories ranging from 1 to over 3,500 hectares. In **Los Angeles**, where crows are colonial nesters, the core territories were about 2 ha compared to the Olympic Penin-



Cliff Swallows gather mud to build their nests; some copulate. North shore of the Assiniboine River on 9 June as some juvenile crows are walking on the ground for the first time in their lives





sula in **Washington** state where pairs of crows occupied an average of 2,100 hectares m50. **NOTE:** Researchers may use different methods to measure and report territory sizes of crows, but overall, the sizes in cities are much smaller than those of crows nesting in the nearby country.

The amount and quality of food available to breeding crows may account for some of the size differences. Sophisticated urban crows have greater access to and eat garbage and junk food more often than country crows that eat unprocessed healthy foods like insects, worms, mice, spiders, the occasional omelet, or a young robin. Some rural crows may fly beyond the boundaries of their territories to a garbage dump to get their fill of our edible wastes. Street-wise urban crows may have a restaurant and garbage bins in an alley on their territory. Dropped food provides a constant supply.

Some researchers suggested urban studies of birds should be organized to examine how our building activities were linked to the quality and quantity of nesting sites, predators, vegetation and food for a suitable group of birds. Areas should be picked for long-term studies of wildlife populations before and after human development has altered the landscape. Wildlife biologist should have some say in urban development to enhance and / or control certain wildlife species d58. Crows roosting in cites is a current world-wide event that has yet to be resolved. As always, people are at the center of the problem and not the crows. Some people applaud the growing number of crows in the city, study and admire them, as I do. Other people find crows disgusting and dirty, and complain to their wholesome and clean politicians that crows disturb their superb, professional lifestyle and should be eliminated. To live in a sterile city without



Slough Grass

annoying wildlife appears to be one of their personal goals. Fortunately, not all goals are met.

Four ways for a crow to acquire a territory in a system of cooperative breeding are –

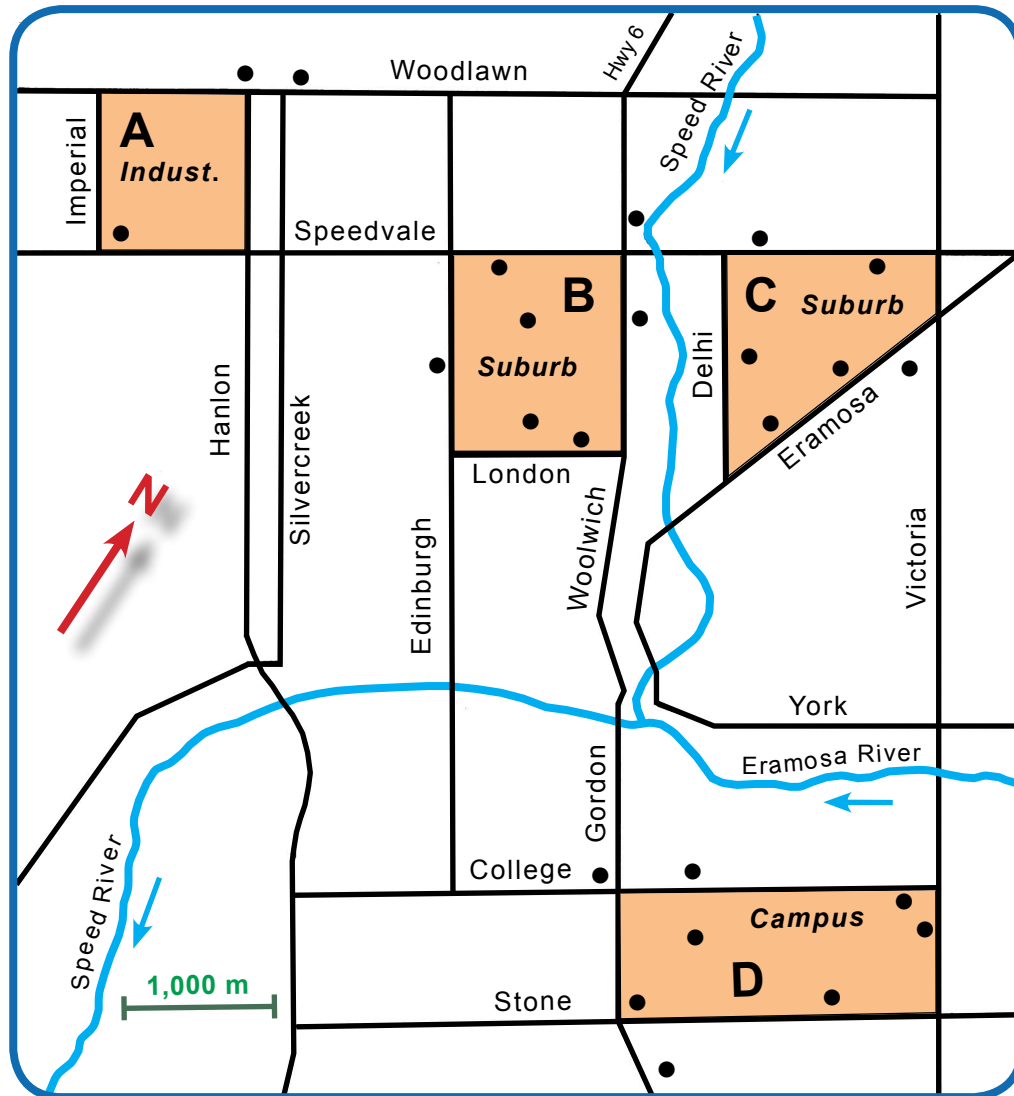
- (1) **INHERIT** – replace a family member on the natal territory
- (2) **BUD** – establish a new territory from part of the natal territory, but do not rely on help from the family
- (3) **REPLACE** – a breeder on a non-natal territory
- (4) **NEW** – set up a new territory away from the natal territory

To acquire a territory, mate, and start nesting, it appears young females disperse greater distances than young male crows. Therefore, it is less likely females inherit or bud part of a natal territory to get going on their parental adventures r97.

Crows were plentiful in Guelph **Ontario** in the 1980s, so I picked four study sites totalling 580 hectares (**Map 81**). Most, if not all the nests, were located over the three years, 1983–'85. Using a total of 67 nests, on and near the four sites, the two closest active nests were 150 m apart in a residential area, and the furthest 1,250 m apart in an industrial zone. The average nearest nest distance was 470 meters. I arrived at a 3-year average of 25 ha per active nest (n 67).

Near Saskatoon **Saskatchewan** in 1987 and 1988, crow nest densities were from 0.36–0.80 per km² (36–80 ha) in treed parkland where 129 nests were located (6 renests not included). Using Breeding Bird Survey data from four routes in 1974–1987, 50% more crows were counted through parkland habitat versus areas of intense agriculture. Continuing with this study in Saskatchewan, the nesting success of American Crows was compared in





81. American Crow 1985, Guelph, Ontario – 24 nests (●), successful and unsuccessful located on 4 sites (total 580 ha; average of 145 ha) during my 3-year study, 1983–1985. The southern site (D) was the University of Guelph campus. Site (A) was an Industrial park, which had few trees and fewer nesting crows

two aspen parkland habitats. There was a sharp difference in 1987 when the nests in the St Denis area produced about twice as many young crows as the nests near Elstow. Permanent water near nests at St Denis seemed to increase the success rate. Overall, the “selection of nest characteristics to evade predators does not appear to provide predictable advantages to breeding crows”.

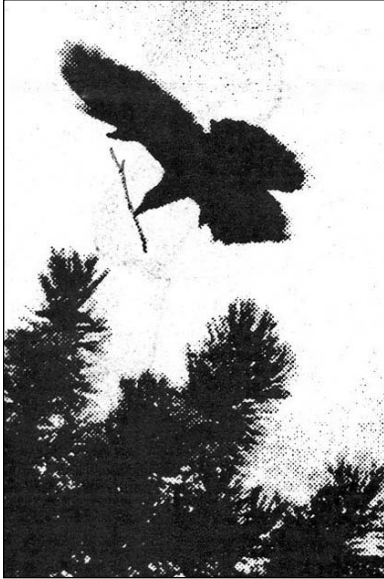
At the two sites, the higher nesting densities at St Denis could have been due to i04 –

- (1) higher production rates in 1987 resulted from more or better food
- (2) more and better nesting sites

In this Prairie Pothole Region of southwestern **Manitoba**, the home range of nesting crows was 260 ha or one square mile ^{84s}.

The Northwestern Crows were the most compact group of coastal nesters further west in **British Columbia**. For 97 nests, only 18 m was the mean internest distance. About 4 m was the





With twig in bill and nest below, the fanned tail and protruding alulae control a crow's flight

shortest length between two active nests. In this off-shore account, the NW Crow was considered a colonial nester 4b0.

In the United States, on a ranch in southern **Florida**, Kilham estimated the two non-migratory unmarked families of crows he studied for several years defended contiguous territories of about 50 ha each, separated by a short common boundary k48. A one-year **Maryland** study in 1943 gave 67 pastoral hectares per nest in the central part of the state 48s. During the late 1930s, Black sampled the **Illinois** countryside and arrived at an average of 59 ha for each breeding pair of crows 20b. American Crows in a 44 ha walnut orchard in **California**, had concurrently occupied nests on average 76 m apart, with several nests about 26 m apart. These nests were rarely in adjoining trees, but the closeness of the pairs suggested a breeding colony. This colony of crows averaged a nest per 0.7 ha e40. On two golf courses in Encino **California**, Caffrey listed the mean breeding density at about one pair per 1.2 hectares. In Stillwater **Oklahoma**, Caffrey noted 32 families averaged about 94 (50–150) ha each v18. The only large nesting colony of eastern American Crows was tallied by WW Pfrimmer in the north-west corner of **Indiana** in the 1970s. In about 1 ha (100 x 100 meters) were 500 nests, a remarkably high concentration 70m. This has never been

duplicated or reported elsewhere. (a typo?)

McGowan mentioned crows in and near Ithaca **New York** remained on and defended their breeding territories in each month, even though they fed in flocks and united to form winter roosts. He envisioned territories as “circular” and provided lengths of diameters to represent their relative sizes. Suburban territories averaged 0.31 km² (n 59) compared to larger rural territories of 0.67 km² (n 18). These figures represented areas of 8.7 ha (0.8–28.3 ha) in the burbs to 37.7 ha (12.6–95 ha) in the outback. With smaller territories in the suburbs, crows were packed closer together at 11.5 territories per km² compared to 2.6 territories per km² in the country. In Ithaca, a drought year in 1995 resulted in smaller nestlings at 28-days of age. So why, asked McGowan, were territories smaller in cities when enough food may be hard to find to feed the young in an off year? He suggested crowding and social organization, or perhaps urban crows cannot judge how big a territory they may need m85. Since crows are relatively new to the city scape, the latter may



American Crow gathering whitish dog hairs from a neighbor's yard on 9 April 2013 to line the nest cup. Late spring, snow on ground in **Winnipeg**





be the best answer. A larger urban territory, where the view is blocked from many angles, may be more difficult to defend and hold against other crows. Smaller territories and nestlings may be a necessary and acceptable part of urban breeding. Like cars in the city, smallness has advantages.

In the countryside of **Iowa**, the foraging area around seven nests averaged 151 ha with little variation. From their nests, crows moved out to a maximum of 1.1 km, and the most distant flight was almost 5 km ^{s33}. In **New Jersey**, the winter territories of three breeding rural families with 2 or 3 helpers ranged from 26–49 hectares ^{71s}.

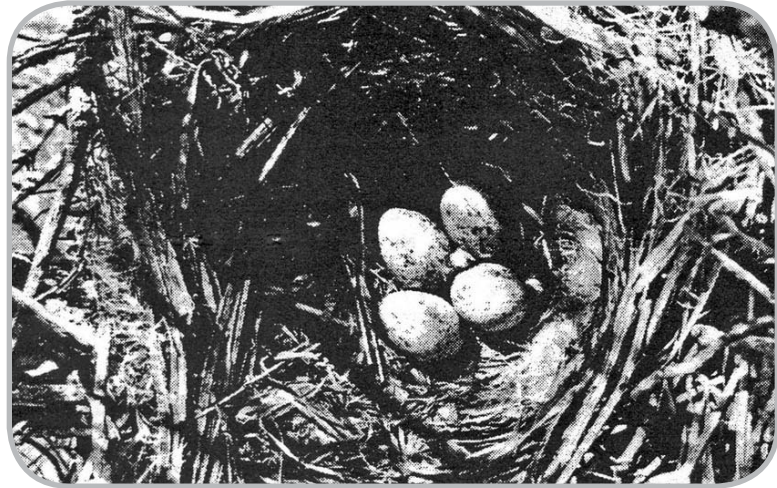
In three habitats in and around Seattle **Washington**, breeding densities were ^{19w} –

urban 5.7 pairs per km²
suburban 3.2 pairs per km²
exurban 0.32 pairs per km²

Along the Pennypack Creek Valley in north-eastern Philadelphia **Pennsylvania**, a park attracted 31 pairs of nesting crows with an average territory of 20 hectares ^{r37}. In two different habitats in Cape Cod **Massachusetts**, the mean territory was 42 (9.4–104) hectares for each of 49 nests. Mean distance between 12 nests in adjacent bordering territories was 0.9 (0.2–2.3) km. Since the marked crows remained on their territories year-round, in subsequent years, the mean intra-nest distance between the year-old and a newly constructed nest within 23 territories was 200 (0–600) meters ^{c56}. In western **Poland**, pairs of breeding Hooded Crows in a National Park held territories 26–38 hectares in size ^{z08}.

Nesting in cities

For birds living in **Jerusalem**, what traits allowed them to adapt to cities? It was concluded that “being successful in more vs. less urbanized environments in the city is not necessarily a factor of brain size nor of how flexible and behaviorally



American Crow A nest with a 4-egg clutch (4 or 5 eggs are the usual clutch sizes) in Essex County, **Ontario** in the 1980s

innovative the species is; rather, it depends on a combination of traits, including diet, the degree of sociality, sedentariness and preferred nesting sites” ^{k16}.

Urban nesting is not a new undertaking for American Crows. There are a few reports of crows nesting near and in American cities in the late 1800s. For example, Frederick Dille collected a set of eggs from a tall cottonwood on Clear Creek on the outskirts of Denver **Colorado**. WN Clute reported two nests within the city limits of Binghamton **New York**. Near the center of Philadelphia **Pennsylvania**, Dr William Bringhamurst saw a pair building their nest in Logan Square. It was surrounded by the Academy of Natural Sciences and a grand Cathedral, etc. – a very busy location. Later he heard about a nest in trees at Independence Square in the heart of the oldest part of the **Philadelphia** ^{2b4}. In Saskatoon **Saskatchewan**, the first nesting crows appeared in the late 1960s ^{35h}.

From March through October 2002, on communal feeding grounds within 1.6 km of South Farms agricultural property of the University of **Illinois**, crows were caught, weighed, banded and placed into 3 age groups. The average home range of all crows (ignoring sex and age) was 7.6 km² (760 ha). By age, 45 radio-tracked crows had average ranges of –

(1) hatch-year (HY) 9.6 km²; (960 ha)





The tan 1 cm wide ends of twigs torn from deciduous trees by crows to build their nest. If the ends of the twigs are gray, you are looking through your field glasses at an older nest

- (2) subadult (AHY) 6.7 km²
- (3) adult 6.4 km² (based on an average of 40 locations per crow)

These are post-breeding territories. Keep in mind that home range sizes vary throughout the year and probably daily. The radio transmitters weighed less than 2 g for a tail-mount and less than 3 g for a collar mount (less than 1% of a 455 gram crow). The tail mount was attached with needle and thread to the rachis of a middle tail feather.



Loose bark on a dead branch is removed and shredded before lining the nest's cup for the comfort of young crows

The antenna did not extend past the feather's tip y11.

On a study area of 39,471 ha made up of the cities of Champaign and Urbana **Illinois** plus adjacent farmland, five types of vegetative cover consisted of –

- (1) agricultural 38%
- (2) low- to medium-dense urban 30%
- (3) high density urban 22%
- (4) forest 5%
- (5) urban open space 5%

Territories overlapped and were not established randomly. Within the study area, crows avoided the forested and high-density urban areas. They preferred the low-density urban and agricultural areas. Crows fed in the country and roosted in the city, usually at one or two night-time sites. For the five habitat types above, there were differences in degree of use by the three age classes. However, there were no differences in composition of habitat on the home ranges used by females and males. For radio-telemetry locations, there were some sexual differences – females liked agricultural and forest habitat, while males used high to low-density urban habitats y11.

In the 1970s, crows were nesting in the cemeteries of Chicago **Illinois**. The American Crow was one of 22 nesting species. The number of individual crows per 100 ha in 10 cemeteries ranged from 0–117. The larger cemeteries attract more birds and species, especially when the habitat was varied. Cemeteries also provide feeding areas for many birds, both residents and migrants 183.

In **Winnipeg and Guelph** the large deciduous and coniferous trees in cemeteries plus abundant lawn invited crows to nest in this man-made, maintained, sustainable habitat.

Nest building

In **Arizona**, nest building lasted from 21 March to 10 May 20c. In Encino **California**, Caffrey cited the first half of March as the start. Near Davis **California**, nest





Nest building occupied part of a crow's day on 21 April 2009 in **Winnipeg**

building probably began in early to mid-March based on the first eggs appearing on 6 April e40. In **Oklahoma**, 22 February to 24 April were the nest building dates in 2001 and 2002 h06. Eastward into **Virginia**, the earliest twigs were carried by crows on 20 February with the average around mid-March c69. Nest construction begins early in the south. The first week in February was noted in **Florida** k63. Two crows plucked white hairs from the back of a grazing cow on 19 February 1946 in Florida, a time when crows were nest-building h35. In Winnipeg **Manitoba**, mid-March was a good time to watch for nest-building activity. Crows began carrying twigs in early March in southern **Ontario**.

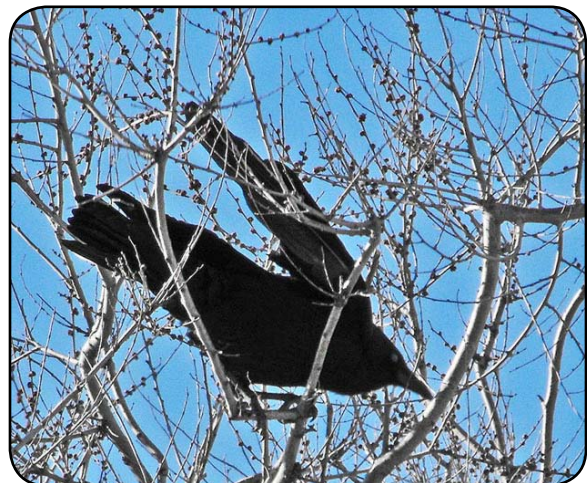
Part of the crow's culture requires the family to build a new nest each year, although, in most large surveys, a few pairs may reuse last year's nest. Only one of 97 nests in **Illinois** was re-occupied over two consecutive years 20b. About 14% of crows in **California** built their new nests on top of some of the 111 old nest platforms e40. At Encino **California** and Stillwater **Oklahoma** combined, none of 223 nests were reused v18. E Good mentioned a nest used for three years in **Ohio** g34. About 26% of Northwestern Crows did the same 4b0. In **Winnipeg**, two different nests were used successfully at least three years in a row, presumably by the same breeding pairs. One nest was near the top of an American Elm growing at the edge of a day-care center with its grassy yard on the University of Winnipeg campus. The other nest was in a group of 20 planted Colorado Spruce near a mowed highway cloverleaf. After

the third consecutive year of use, I stopped checking. But a few years later, the same nest in the spruce was in use. Both reused nests appeared to be refurbished, mostly the lining I suspect, and appeared to be the same size as the previous year's nest. The success of a nest was necessary before it had any chance of being reused. What triggers a pair to reuse their nest is unknown. In **Winnipeg** two other nests in different elms were about level and 5 m from a street light which illuminated the nest and young at night. Both nests were successful, but not reused the following season r28.

A crow's nest disappeared after one year in a small deciduous tree in **Essex County**, in a tall spruce tree in **Guelph**, and in an American Elm and spruce in **Winnipeg**. Usually a old nest lasts for several years, when supported by an array of branches on all sides. A wind storm, a person, or a poorly placed nest by a first-time breeder may hasten its removal from the branches to which it was attached.

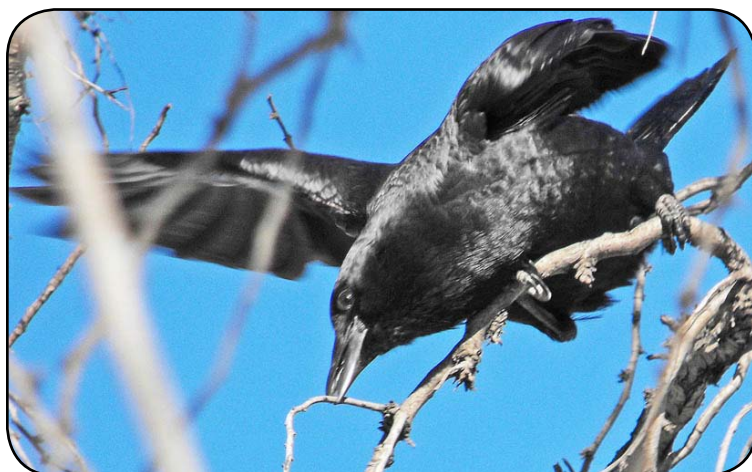
Trees

let's face it are obnoxious
rooting holes in foundations
bullying fences into leans
cracking concrete walks
grabbing any space they can for their ridiculous
canopies



A warm sunny spring day compels a crow to find a twig for its nest





Twigs to build a nest are taken from deciduous trees. Crows break off rather thick twigs for the outer layers. Nest building may begin in the middle of a mild March in **Winnipeg**

dropping sticky fluids
tossing twigs all over the place
never cleaning up
self centered narcissistic
admiring themselves in pools
combing their hair with the wind

– David Scott 2010

In **Winnipeg** crows often build their nests in trees located in or near large mowed grassy areas or a collection of lawns within the pairs' territory. Parks, cemeteries, schoolyards, golf courses, highways with wide mowed edges were attractive to nesting / feeding crows. At the same time, crows nested downtown where little lawn was available near the nest and with pedestrian and vehicular traffic abundant beneath their nest tree. Since people rarely look up, the location of a nest remained hidden. Nests in trees in a front or back yard may pass unnoticed by some homeowners.

Remember that "few habitat and nest-site selection papers have addressed why the selection of certain habitats was adaptive for the species in question." Further, "comparisons of used habitat with available habitat

are more appropriate than comparisons of used and unused habitat. Definitions of habitat availability ought to be informed by the natural- and life-history characteristics of the focal species" j45.

Nest architecture

The construction of a nest with grass, weeds, vines, bark, leaves, mud, and living or dead deciduous twigs results in a large bulky structure near the treetop. In **Guelph** I obtained three nests from small trees. They weighed 770 grams (an incomplete false one), 1,200 and 1,700 grams. I unravelled 190 twigs from the small 770 g false nest, which represented

190+ separate nest-building trips. Twenty-five of the largest deciduous twigs from this small nest averaged 45 (26–72) cm long and each weighed 11 (5–21) grams. The largest vine was 1.2 m long and weighed 3 grams. E Good did not find any twigs over 61 cm long used in nests g34. I have watched crows use small pieces of plastic sheets as nesting material in **Winnipeg**. One description of the central cup of a crow's nest went like this. "The soft compact lining was entirely of finely separated fibrils of bark, which apparently were shredded by the birds before being placed in position." Depending on availability, other nest-lining materials were – moss, grass, feathers, twine,



If you see a crow moving awkwardly in the middle of a deciduous tree in spring, it's probably gathering twigs to build a nest





rags, wool, fur, roots, leaves, hair and seaweed, etc 9⁷⁵. From **North Carolina**, another list of nesting material included – cypress bark, moss, sticks, layer of earth, roots, pea and potato vines, lined with grape vine bark, moss or hair 2^{b4}. Black mentioned sticks up to 2 cm thick made up the outside of the nest 20^b. The sticks were placed with the thick ends to the outside of the rim, their visible tan ends indicated a fresh twig and nest (easily noticed through binoculars).

The sizes of 14 nests in **Ontario** –

Nest diameter 30–76 cm
Nest thickness 23–30 cm
Cup diameter 15–22 cm
Cup depth 10–15 cm p25

For 6 nests in **Illinois** –

Outside nest diameter **52** (35–76) cm
Outside nest depth **30** cm
Cup diameter **24** (20–25) cm
Cup depth **15** (10–20) cm 20^b.

In two different habitats (1983–1987) in Cape Cod **Massachusetts**, 17–19 nests of marked American Crows had –

Nest diameter **41** (17–48) cm
Nest depth **24** (10–38) cm
Cup diameter **24** (16–36) cm c56

Figures on nests of crows from **New York** and **Pennsylvania** –

Nest diameter **43** (30–61) cm
Nest depth **27** (18–51) cm
Cup diameter **19** (15–23) cm
Cup depth **11** (8–13) cm 2^{b4}

Nest building trips

From a third-floor office window in Fort Collins **Colorado**, Stanley watched a pair of Black-billed Magpies build their nest. It appeared larger than normal and contained 1,910 sticks and weighed



Male flowers of a Manitoba Maple are elongating in early April as crows are building their nests in Winnipeg **Manitoba**

6.8 kg when dry. The average stick weighed 3.6 grams with an average length of 29 cm. He estimated nest construction needed 2,560 trips, 276 km of travel, 8.5 hours of flying time and cost 209 kJ of food energy at a minimum or 2.6 kJ per adult per day. He thought each magpie had to increase their energy intake about 1% to cover the cost of 40 days of nest-building 3^{7s}. A joule is the energy needed to lift a small 100 gram apple 1 meter straight up. A kilojoule = 1,000 joules (wiki).

Marked Black-billed Magpies in **South Da-**



Ripe (red) and unripe fruit (berries) of Bittersweet





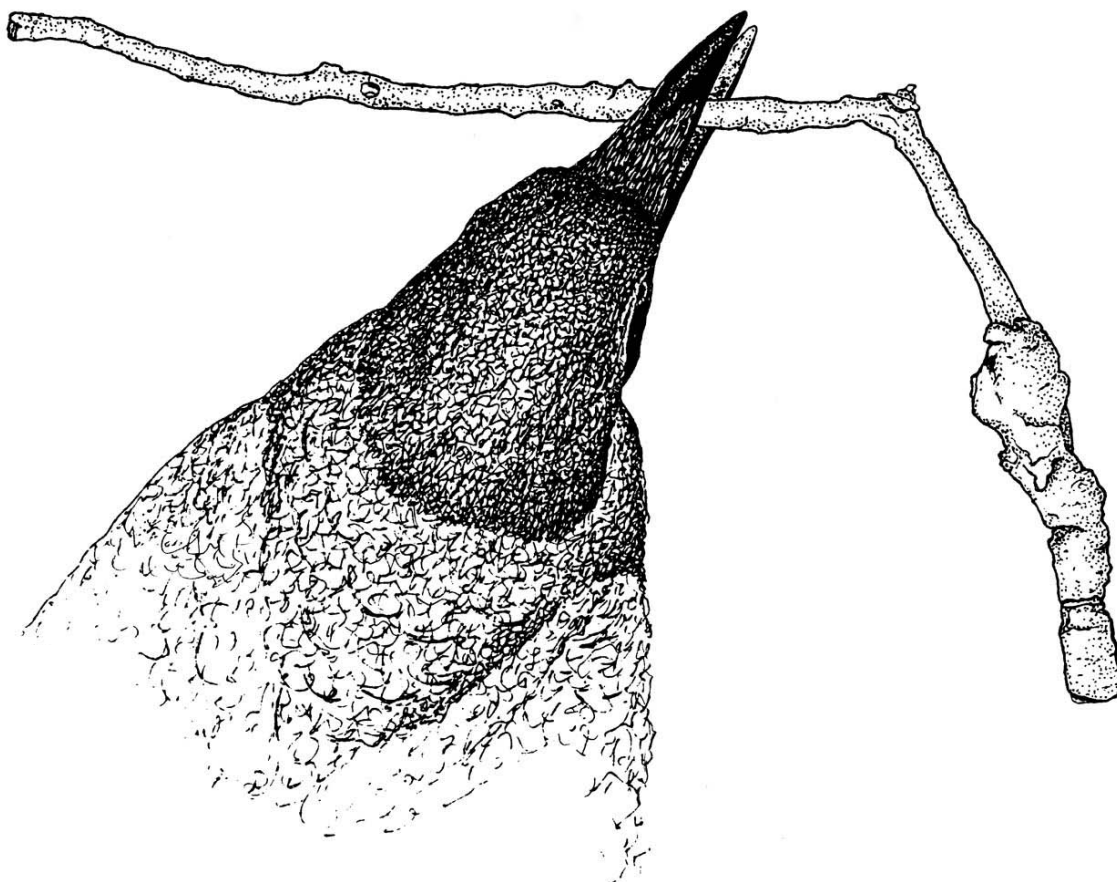
kota revealed some of their nesting habits. During nest building, females made 37% of the trips with nest material. Once on the nest, females used 44% of that total time to actually build the nest. The male magpies made most of the trips with material and did most of the nest building (304 hours of observation at 16 nests).

The day before laying began, and for about 5 days once laying started, female magpies did most of their begging away from the nest. They followed the male as he looked for food. Several days after laying ended and incubation began, the female on the nest begged very little (135 hrs, 11 pairs).

Nestling magpies fledged at 24–27 days. Overall, the male made more feeding trips to the nest than she. When the nestlings were 13–24 days old, he averaged 3.5 feeding trips per hour compared to 2.6 by her. He fed the 37–48 day old juveniles 2.6 times per hour compared to 1.9

times per hour by the female (928 hrs obs.). At two nests, one mate was lost 2 days after the young fledged. The remaining male at one nest and the female at the other nest almost doubled their feeding rates to the juveniles and succeeded in raising their young to independence at about day 60 after fledging. Only one juvenile was lost from each family. Male magpies do not incubate or brood the nestlings. If the female is lost at this time, the nest would not succeed. Specialization in nesting duties can have harsh consequences if predation is high 1b1.

It is 21 March 1983 in **Guelph**. Killdeer, robins, redwings and grackles run, hop, flutter and call around me. But a crow has my attention as it goes about its morning's work. I scribble in my notebook – “A crow pulled two living twigs from a deciduous tree, both were dropped. Then it flew to a large maple. Again, with its bill it



An American Crow in its nest-building mode decided this twig was not useful





American Crow arriving at nest (arrow) in its early construction in a Siberian Elm

tore off a large twig which it placed under its toes. Several bouts of 3 and 4 caws followed. It picked up the twig again, then put it back under its foot, called once more and flew off letting the twig fall to the ground.” As this reveals, nest-building can at times be a sporadic activity. With other crows moving through the area, vocal identification of self and territory are as necessary as nest-building itself.

In **Oklahoma**, the breeding pair made the most nest-building trips – 84% of 211. Helpers made 15% of the trips and 2 trips were made by an unidentified American Crow. One 4-year-old male made 74% of the 31 nest-building trips contributed by helpers. Other helpers were 2- and 3-year olds (5 males and 2 females). Breeders made an average of about 2 nest-building trips per hour. Trips to the nest by crows carrying sticks

and nest lining material were equally shared by male and female breeders, although at one nest the male breeder was not observed contributing to any nest-building activity. The actual building of the nest was also equally shared between the female and male breeders. Only 11% of the time did a breeder (M or F) give its nesting material to its mate for building h06.

On the ground in **Guelph**, a crow walked about and visually rejected many fallen twigs. A few twigs, one at a time, were picked up and immediately dropped. Eventually, one twig balanced nicely in the bill, had the right weight, and was shaped to the crow's liking. It rose with the bird to the nest. Along the way, another crow landed in a conifer, passed a deciduous twig from its bill to its foot, broke off a side twig with its bill, then carried the improved twig to the nest. When transporting a long vine, one end was held in the bill as the rest trailed below and behind the bird against an even gray sky.

City crows have two types of grass available to line their nests r25. They can gather the short lawn grass, or the more sensuous, varied, wild types. Sometimes crows worked in a hurry. One bird walked and ran from clump to clump of wild matted dead grass as it tore off bits 31 times until its bill was filled. With stems and leaves extended to about 10 cm on either side of the bill, the crow passed overhead on the way to its nest. A roundish brown clump 6–8 cm wide in the bill was lawn grass travelling to a nest. As additional nest lining, crows stripped bark from fallen decaying logs, dead branches in living trees, the bases of trees, or vines along buildings. Rotting deciduous





Spikelets of Great Bulrush

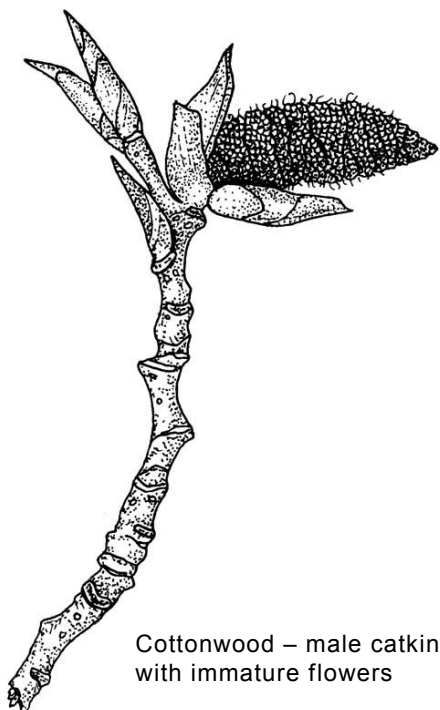
leaves from the previous fall were gathered from the ground by the beak-full. Nests of crows held animals' hairs in the inner lining – horse hair 50%, hog bristles 40%, sheep's wool, feathers, and cow's hair together 10% 2b4.

“The evident knowledge displayed by the early breeders in choosing the warmest material at hand; and the late builders in lining their nests with what is undoubtedly the coolest, speaks highly for the intelligence of the bird.”

Nest-building was generally a morning activity although building did occur on and off throughout the day. Snow, rain, and buffets from a 60 kph wind do not interfere with nest-building. Within minutes of bracketing a sunrise, crows began

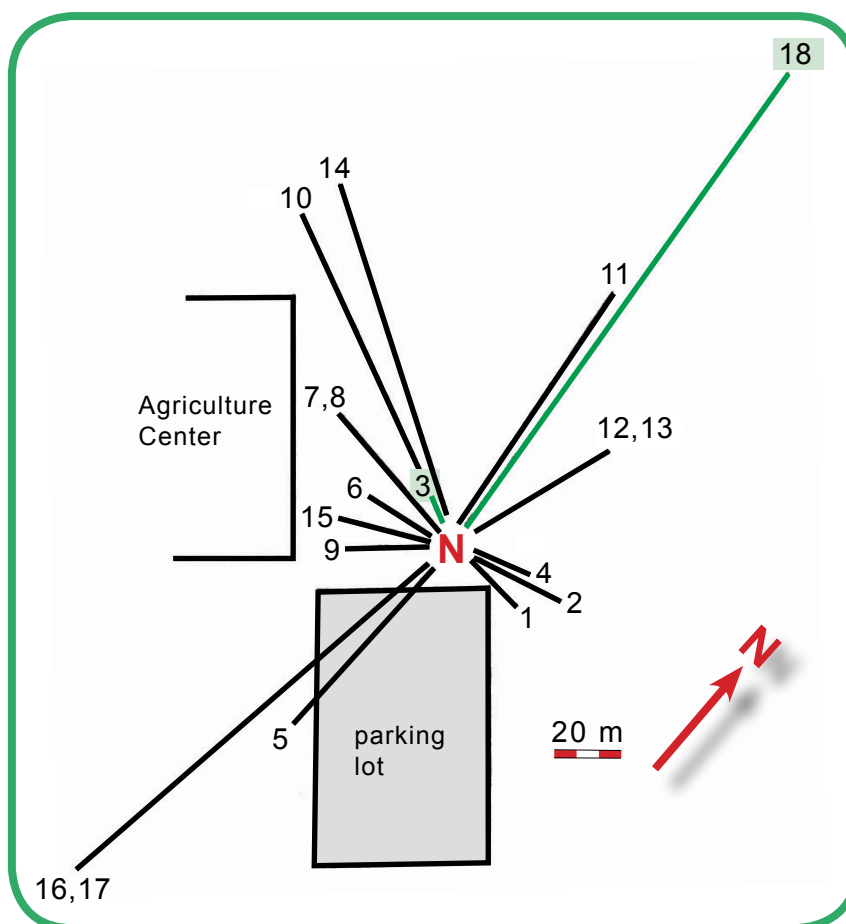
working on their nest. At the end of a day, the latest twig carried to a nest was 45 minutes before sunset. When helpers worked on nest-building, a nest-traffic controller was sometimes necessary. I have watched three crows arrive on a nest together. Kilham counted up to five crows in **Florida**, each with a twig, together at their nest. As one adult did the building, the others queued with their contribution k47. Alone at a nest, one crow entered its twig into the structure. On a rainy April morning in Guelph **Ontario**, I was entertained by a family of three crows behind a public art gallery. One bird gathered twigs and made several trips to build its nest in a pine tree, while the other two birds simply flew along with it. Carolee Caffrey mentioned the female crow did most of the fine work in the cup of its nest v18. Sometimes when a helper tried to help, it was chased from the nest by a parent, probably the dominant breeding male, even though the helper carried a twig in its bill k53.

An idea for discovering how birds organize themselves may come to me as I daydream, or when I was in the field watching a courage of crows in action. The latter situation led to a closer look at the searching techniques by a pair of crows in Guelph **Ontario**. On 26 and 27 March, working alone as usual, I quickly recorded the approximate directions and distances from which two crows, without a helper, gathered nesting material. A couple of obscure points need to be mentioned. First, all of their trips to gather material were within 200 m of their nest in a conifer, and second, the directions and distances of searching usually changed with each trip. Sometimes consecutive trips were in opposite directions (Map 91). It can be argued that crows could use (for ef-



Cottonwood – male catkin with immature flowers





91. American Crows gather nesting material from different deciduous trees and directions around their nest-tree, but not from the nest-tree itself. The gathering distances ranged from 15 (trip #3) to 200 (trip #18) meters on the mornings of the 26th and 27th of March 1987. Map shows the sequence of 18 nest-material gathering trips by 2 crows (no helper) in 64 minutes around their nest (N) in Guelph **Ontario**

iciency) only one or two nearby trees from which to gather their supply of twigs, but they do not. Obviously, the directions and distances were partially determined by the type of material needed. However, at the same time, the trips allowed the birds to maintain surveillance near the nest for intruding birds and to look for food. In summary, it was a level of organized searching controlled by the physical properties surrounding the nest, neighboring crows, plant species, along with the abilities and personalities of the crows ^{r25}.

The construction process for the first nest of the year for an American Crow may require up to 23 days, with the maximum nest building trips at about 7 per hour for a crow. If the first nest was lost, the second or third attempt may be com-

pressed into 12 days, with the highest number of trips to the nest with material at about 12 per hour for an individual breeder or helper ^{h06}.

Nest-building (first nests of the season) in **California** took an average of 13 (11–17) days for 6 nests ^{e40}. Carolee Caffrey mentioned 10–14 days in **Oklahoma**. Second nests took slightly less time to build, 5–10 days ^{v18}. Kilham recorded 5 and 9 days for building 2 nests in **Florida** when helpers were helping ^{k63}. The shortest period (5 days) was reported by Kilham, who watched a pair of crows with up to three helpers complete the task in Florida. This was followed by about two weeks of inactivity until egg-laying began ^{k47}. A small race of American Crows near Davis **California** took about 13 days to complete





their first nests and nine days for renests. Once nest building was finished, egg laying began e40.

In **Saskatchewan**, crows completed building their earliest nests on 21 and 29 April in two areas, which was followed by a delay of about 5 days before egg laying began i04.

Renesting

In southern **Florida** in 1982, an unusually warm December stimulated an early start to nest building. Soon the female was incubating on 16 January 1983, which turned into a year with well above average rainfall. Ten days into incubation the nest failed (reason unknown) and the female began gathering sticks for a new nest the same morning. She (with helpers) completed her second nest in 6 days, only three days after the second family Kilham was watching completed their first nest. In the second week of February both nests were lost. Kilham saw a raccoon sleeping in each nest. Both family groups renested, one with a new nest, the other laid another clutch of eggs in her second nest 13 days after the raccoon left. This family lost their 3rd nest to a raccoon on 4 March. The second family of crows lost their second nest 8 days earlier. Undeterred, both families rebuilt and finished their nests 2 days apart. These nests, the 3rd and 4th of the same season, finally held nestlings 12–15 days old on 15 April. The 3rd nest of the second family developed a tilt and the nestlings fell to the ground. Kilham suggested the high amount of rainfall and flooding may have forced raccoons to move, and they happened upon the nests of these two families of crows. In an unusually dry year in 1985, only one nest was lost to raccoons, possibly because the nest-tree, of the 4 used by the crows, was situated in a wet area. Renesting four times in one season is the highest number recorded in North America k61.

As I went about watching crows in **Guelph**, I soon realized they were looking back, especially when I left my vehicle and walked in the open. A crow, with its bill stuffed with grass, landed on a flat light fixture across the road from its nest in a pine. I was leaning against another pole 30 m away. I looked at the crow; it looked at me. In a few minutes I grew tired of the duel. I walked to my car, passing below the light. The bird looked down and shifted its position to keep me in view.

Once I was inside my car, the crow flew to its nest and began building.

False nests

False nests are an unresolved avian phenomenon. In an **Ohio** woodlot Good counted four false starts by a pair of crows 934. Some of Guelph's crows, with or without helpers, built one or two false nests in a breeding season. Are false nests the hallmark of young, inexperienced crows nesting for the first time? Marking crows will determine if this is so. Do crows that build false nests do so most years, or do they outgrow the habit? And what percentage of paired crows in the population engage in false nest building? Some small structures of only a few dozen twigs can easily be overlooked. At one false nest in an American Elm in **Winnipeg**, a crow stopped building when the nest was a donut-shaped structure of outer twigs complete with a wide hole in the middle (below).

false nests add to the frustration of trying to locate an active nest. One week you think you have a nest pinpointed, but when you returned several days later, it sits idle while the crows are busy making another nest in a nearby tree. One morning in March I saw a pair of crows, without a helper, working on two large



American Crow A completed false nest built by one member of a family with 2 helpers in an American Elm on the University of **Winnipeg** campus





American Crow's nest cup and eggs in the collection of the Royal Ontario Museum in Toronto

false nests. At one point, both false nests were being built simultaneously in two pine trees 50 m apart. One crow carried twigs to one nest while its mate gathered material for the other nest. Eventually a third nest, the successful one, was constructed in another pine tree 100 m from the first false nest. The trunk dbhs of these three pines in a cemetery were 71, 69 and 74 cm, which showed a consistency in tree size and species selection by this pair of energetic crows. Generally, false nests were within 100 m of the nest finally used. Which sex decides to start or stop nest-building is another unknown. Twelve false nests were constructed by breeders and helpers in a Cape Cod **Massachusetts** study c56.

Hundreds of trips are made by crows to their nest over the 1–2 weeks necessary for its construction. I decided to look into the temporal aspects of the building procedure. In all, 173 building visits by several pairs of crows, some with helpers were timed. I began timing when a bird with material in its bill landed in the nest tree, to when it left. The average visit lasted 115 seconds. The shortest visits were in the 10–20 second range, when a crow left a twig or grass for its mate on the nest to weave into place. The longest visits, over six minutes, were often by a crow adding its material to a nest as well as that left by its mate or a helper. Sometimes a crow visited its

nest without material.

A nest built near the top and side of a conifer allowed the family members to come and go with ease. Some birds landed and left directly from their nest during the building process. Others landed on a branch and with one or two short hops reached the nest's rim. One crow worked in a special manner. It is always the aberrant crows, as with humans, that are the most interesting to observe and write about. With its false nest situated on a side limb of a tall pine, and open well-spaced branches along the trunk, this crow landed several meters below the nest and hopped / flew up to it branch by branch. With material in its bill, 15 trips were timed. An average of about 2 minutes passed from

when this crow entered the pine to when it left the nest (a little longer than normal). However, about 20% (4–52%) of this crow's nest-visiting time was used for branch hopping until it reached the nest. At their second false nest, both crows alighted in normal fashion from above.

Once crows were in the nest-building mode, the interval of time between visits to the nest averaged 7 (1–32) minutes (n 202). This time was mainly used to gather material and travel to and from the nest.



Discarded food in the city always provides a new snack for a crow on its territory





during nest-building, family members came and went at the nest quietly. On the nest, the female was heard by Kilham to give “low growly notes as she pushed new or other sticks into place.” Sometimes this developed into a shudder call which Kilham heard at quite a distance. Because the shudder call personified exasperation, he thought it might warn family members to keep away for the moment, until the difficulty of weaving the twig into the nest was finished ^{k60}. Standing beneath a nest-tree, I have also heard what sounded like (in human terms) exasperated noises from a crow trying to work a twig into place.

One evening in **Winnipeg**, I was looking at a nest in an American Elm one block from my home. In the area I saw a crow with a 60 cm long twig, decorated with a few short side projections, in its bill. The crow then landed in the elm at what was the start of its nest. A clump of large twigs was in a circle on a thick horizontal limb. Through binoculars I watched this crow as it tried to work the new twig into the structure. It used very short, rapid, back and forth movements of its bill. This didn’t achieve the desired outcome. Then, when it raised the twig with its bill, another twig was tangled with it. Three times the crow raised the twig, but the tangle remained. Frustrated, the crow sat low and quietly on the thick limb without moving for about 20 seconds, before it flew off. Two days later the nest was much bulkier. The crows continued to build at this site.

Crows’ nests used by other birds

Other birds sometimes occupy or use a crow’s nest. Usually it is an unused nest. In June in **Guelph**, an Eastern Kingbird twice stole nesting

material from the cup of a deserted crow’s nest. In the interior of **British Columbia**, two pairs of Barrow’s Goldeneyes, *Bucephala islandica*, (46 cm long) nested in older nests of crows on Abuntlet Lake. One occupied nest (6 eggs) was in a willow, and the other nest (8 eggs) in an Sitka Alder, *Alnus sinuata*. Each nest was over water. The two clutches were fully hatched by 28 June. The researcher reminded us this was an instance of crows indirectly increasing the breeding success of a duck species by providing nesting sites ^{e14}. Then another Barrow’s Goldeneye incubated five eggs in a crow’s nest in a Lodgepole Pine, *Pinus contorta*, (dbh 10 cm) in the Cariboo Parklands of British Columbia. The use of a crow’s nest might occur at higher altitudes where trees were less common for the normally, cavity-nesting goldeneyes ^{80s}.



Downy nest of a Barrow’s Goldeneye with 6 eggs in a pre-owned crow’s nest in a willow over water in the interior of British Columbia – an instance of crows helping ducks nest successfully ^{e14}, © the Wilson Ornithological Society, with permission

On 10 June 1904 on a small island in the St Lawrence River, an American Black Duck, *Anas rubripes*, nested in a pre-owned crow’s nest in a large elm. About 14 m above the ground, the successful nest held 10 eggs and much down. ^{b69}.

Goss, in the late 1800s, was out killing kites. He was gathering their eggs for his personal collection. On 27 May, he saw a pair of Mississippi





Kites, *Ictinia mississippiensis*, (length 37 cm) associated with a pre-owned crow's nest. A few green twigs in leaf were added to the cup's lining, a common practice for kites. The nest was in the fork of an oak and about 12 m above the ground. To maintain the respect of his friends, he finished his article with "This nest and the ones examined of *E. forficatus* were on the breeding grounds of the common Crow, which accounts for the robbery and the few eggs found" 950. Unknowingly, he may have been talking about the Fish Crow which occupies part of the same range in Florida as the Swallow-tailed Kite (*Elanoides forficatus*).

A Merlin, *Falco columbarius*, (length 31 cm), used an abandoned American Crow's nest near the top of a 10 m Balsam Fir, *Abies balsamea*, in Terra Nova National Park, **Newfoundland** in 1987 d30. Near Saskatoon **Saskatchewan**, field work was conducted (1970s) on the nesting habitat and success of Merlins along a 40-km section of the North Saskatchewan River. Most Merlins' nests were in used American Crows' nests near the tops of older spruce trees (*Picea* sp) in Saskatoon. Along the river, old crows' and magpies' nests in willows were preferred. Successful nests by 47 pairs fledged a high average of 4 fresh Merlins o11.

Nest-site selection by Merlins was studied within Saskatoon **Saskatchewan**. Merlins preferred older parts of the city where they nested in old crows' nests in conifers – White and Blue Spruce. The large number of House Sparrows, *Passer domesticus*, supplied Merlins with the necessary food to set up shop l40. House Sparrows made up 84% of the prey of male radio-tagged Merlins in the city 09s. Productivity (young per successful nest) was slightly higher in urban compared to rural areas on the prairies. In rural studies, Merlins' nests were mostly in deciduous trees in shelter belts, and they favored closed magpie nests over the open-cup nests of crows w23. In **Montana**, nesting attempts by Merlins were reported in the early 1970s. All 8 nests in 5 counties were in conifers. Old nests of magpies and one crow's nest in a Ponderosa Pine were used e30.

When several pairs of Swainson's Hawks, *Buteo swainsoni*, (length 53 cm) nested in Regina **Saskatchewan**, at least one of the hawks

used an older crow's nest j12. There were three instances where Long-eared Owls, *Asio otus*, (length 38 cm) occupied newly constructed crows' nests in southwestern **Manitoba**. As well, three Long-eared Owls nested in older nests of crows with each nest 5, 35 and 40 m from an active nest of an American Crow. No interactions were observed between the two species whenever the nests of the crows were checked 86s. In the Bretona ConservAction Area near Edmonton **Alberta**, a pair of Long-eared Owls occupied an older nest of a crow situated 2.5 m above ground in a Pin Cherry, *Prunus pensylvanica* 16k.

Frederick M Dille of Denver **Colorado**, listed the following birds using pre-owned nests of crows – Long-eared Owl, Sparrow Hawk, Cooper's Hawk, Broad-winged Hawk, and Great Horned Owl 2b4.

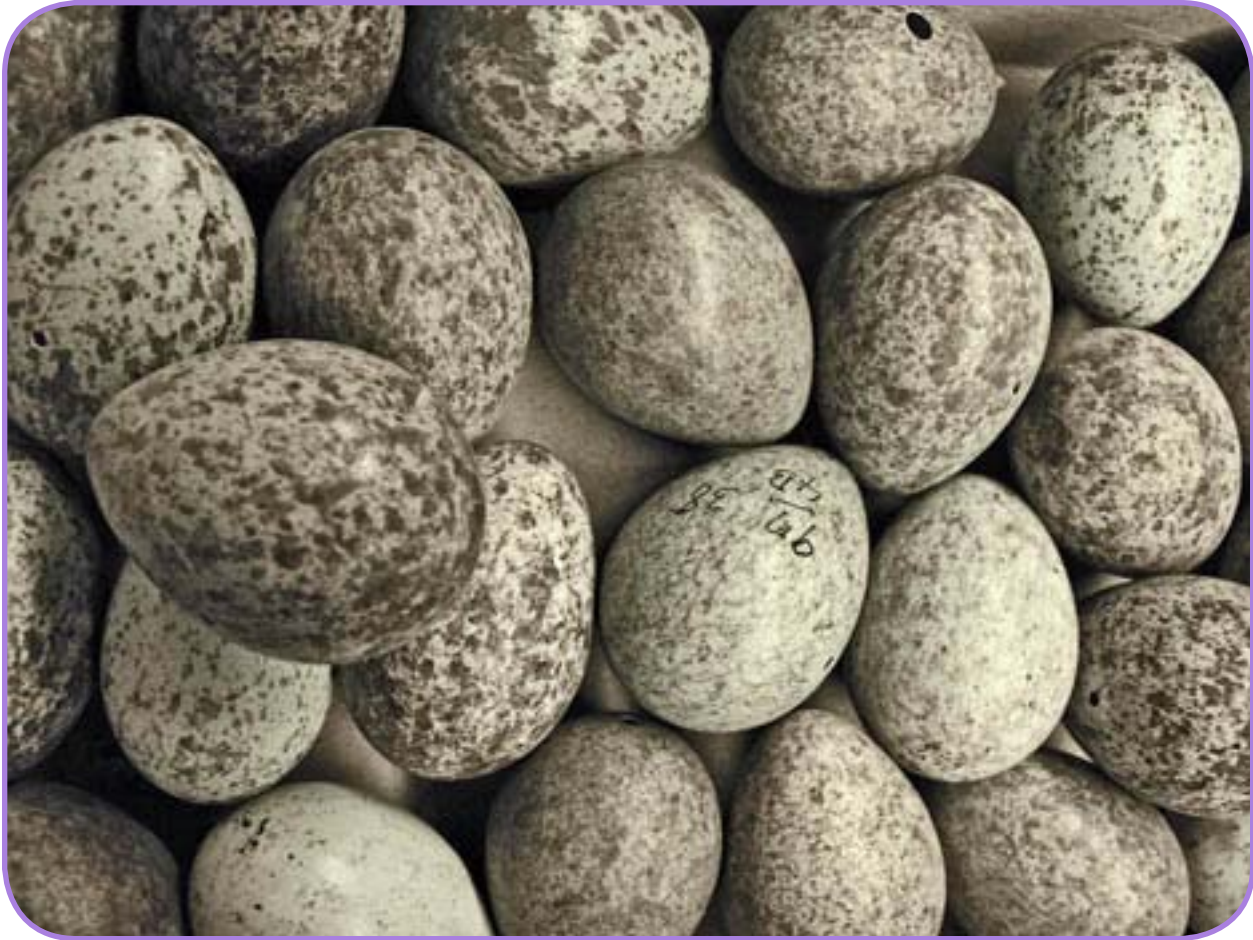
In three northeastern states, nest locations of Great Horned Owls, *Bubo virginianus*, (length 56 cm) were examined in rural and urban sites. Where 61 nests built by other species were identifiable, owls nested in old nests (18%) of American Crows and (39%) of Red-tailed Hawks s98. In **NJ**, **NY** and **CT**, 49% of 33 Great Horned Owls' nests were in pre-owned nests of Red-tailed Hawks and 21% in old nests of the American Crow. In return, crows became 4% of the owl's prey 33b. Thank you very much.

Great Horned Owls' nests (48) were in previously-owned nests of several species, in-



American Crow Throat pouch bulges with food as it gathers invertebrates from a lawn, not corn or nestlings, to feed its large nestlings on 28 May 2011





American Crow Eggs in the collection of the Royal Ontario Museum in Toronto **Ontario**. Bluish underlying color of shells was faded in these decades-old shells. Eggs average 4.1 x 2.9 cm

cluding American Crows ⁹²¹. Long-eared Owls often used unoccupied crows' nests at Kewanee **Illinois** ^{71m}. In the southern states, Mississippi Kites nested in old nests of American Crows ^{p07}. Long-eared Owls along the Snake River in southwestern **Idaho** always nested in old corvid nests – 70% magpie and 30% American Crow. The owls did not build their own nests. Most corvid nests were near the periphery of a grove of trees, which was where the owls nested ^{m34}.

Martin wrote in *North American Birds* (northern great plains region) about the positive relationship between American Crows nesting in cities and the advent of Merlins, which used pre-owned crows' nests the following years in which to raise their young. From 1995–1998, Merlins nested in downtown Dickinson, Grand Forks and Minot **North Dakota**. On the flip-side of the coin,

Common Nighthawks, *Chordeiles minor*, (length 24 cm) seemed to be declining in North Dakota. In the Hudson-Delaware Region, nesting crows increased in the city and at the same time there was a decrease in rooftop nesting by nighthawks ^{m43}. But no direct proof. Perhaps insects are declining, or roofs are becoming unsuitable nesting sites due to new architecture.

In the Kielder Forest, Northumberland, **United Kingdom**, Carrion Crows nested in tall Sitka and Norway Spruce. Some Merlins quickly switched to nesting in the pre-owned nests of these crows instead of on the ground, as was their custom. This meant Merlin productivity increased from 1.1 nestlings per ground nest, to 2.5 nestlings per tree nest. For each year from 1988–1990, over 50% of the Merlin population nested in trees ^{l50}.





American Crow Nest with a clutch of 5 bluish-green spotted / streaked eggs. The lightest egg in the middle-right may have been the last one added to the clutch, © By Dr. Kevin J McGowan, with notification. From Birds of North America online

Eggs

It was first demonstrated by Rowan that a gradual increase in day length during the vernal season in the Northern Hemisphere was the main stimulus for increased testicular growth in male birds ^{30r}. Superimposed on this, temperature had an adaptive value in regulating reproduction. For example, a cold spring dampened the Black-billed Magpie's breeding activity so that when nestlings did hatch, food was more abundant ^{j52}.

From the quiescent winter period to the time of egg deposition, the internal reproductive organs of American Crows exhibit a dramatic size increase. In December, the tan colored testes, set against the darker red kidneys, were 3–5 mm long in adults. These expanded to 15 (8–22)

mm by April and May. By comparison, 11 non-breeding yearling males had 10 (6–15) mm long testes in the spring ^{j36}. The testes of adult crows in **Illinois** increased about 40 times in volume, from 0.05 to 2 cm³ (January to March). Those of yearlings showed only a 21 times increase, 0.015 to 0.3 cm³ ^{20b}.

Along the way, Black examined 884 ovaries and indexed their ventral surface area. Prior to the enlargement of single ova, adult ovaries expanded from 84 to 127 units – January to March. Those of yearling females stayed smaller, but still grew from 62 to 102 units over the same time period. Within the short, latitudinal distance covered by the state of **Illinois**, the gonadal development of southern crows was about two weeks ahead of that for the state's northern crows ^{20b}.

AD Young decided to examine breeding American Crows west of Weyburn **Saskatchewan**. He shot 20 females on or near their nests from 10 April to 29 May 1987. Nest days were “the total number of days females had committed to reproduction” based on the laying of one egg per day, an 18-day incubation period, and length of nestling period. He wanted to study their stored nutrient reserves during four stages –



American Crow The spots and blotches on eggs vary in intensity and composition. Most of the shells' colors were desaturated in Photoshop. Clutch at the Royal Ontario Museum, Toronto **Ontario**



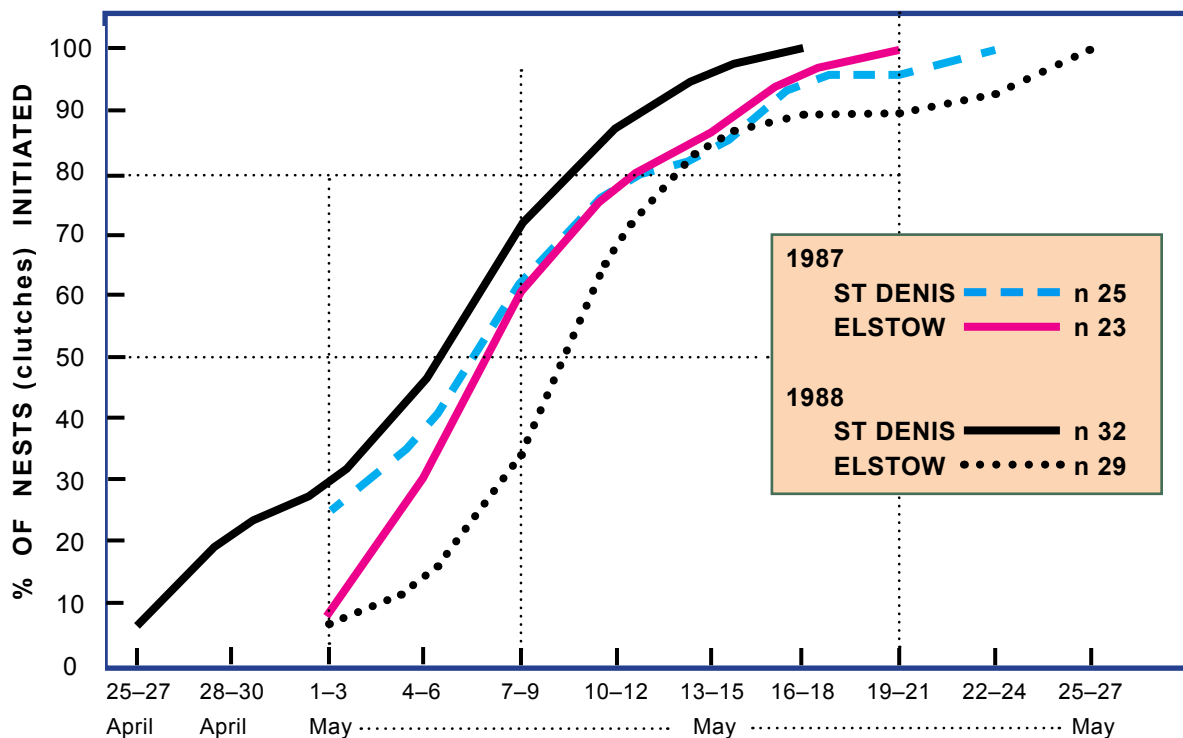
The Breeding Season



Study area	1987			1988		
	Density	Nests	Renests	Density	Nests	Renests
St Denis	0.6	27	3	0.8	37	1
Elstow *	0.4	31	1	0.4	34	1

* Density figures exclude seven 1-km² blocks with no suitable trees for nesting

98. Nests per km² were higher in the St Denis area of Saskatchewan i04



98a. By 7–9 of May about 50% of the clutches of American Crows were initiated in Saskatchewan i04

- (1) rapid follicle growth (RFG)
- (2) egg-laying
- (3) incubation
- (4) nestlings

The weight of body fat (ether extraction) in female breeding crows ranged from about 20–60 grams (4–12%) of the weight of a 500 g crow. It was found –

- (1) dry body weight of female crows remained fairly constant during egg formation, incubation,

and the nestling period

- (2) body and reproductive fat changed little in relation to nest days
- (3) two females with the least amount of body fat were the last to begin egg laying
- (4) protein was stored during RFG and used during egg laying
- (5) stored calcium was not used to produce shells of eggs
- (6) during incubation and when feeding nestlings, protein and body fat remained unchanged
- (7) body fat tended to increase during incubation

